ROTEM®
Control & Management

AC-2000 Plus and AC-2000 SE

Controller

User Manual

P/N: 110049

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Take Control©

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1 FRONT MATTER

This section includes information on the manual and general information.

1.1 Introduction

Rotem manuals provide easy-to-use information regarding the installation, operation, long/short term planning and parts listing (this manual may not deal with all of the above subjects). The table of contents is an outline of the relevant information in this manual.

Read this manual before operating your Rotem product. Using this equipment for any other purpose or in a way not within the operating recommendations specified in this manual will void the warranty and may cause personal injury.

If you have any questions or comments regarding your product, please contact your local Rotem dealer.

1.2 Conventions

NOTE: Notes provide important details regarding specific procedures.

CAUTION **Cautions alert you to potential damage to the controller if the procedures are not followed carefully.**

WARNING! **Warnings alert you to potentially hazardous situations which, if not avoided could result in death or personal injury.**

1.3 Contact Information

Rotem Control and Management

Email: support@rotem.com **URL**: www.rotem.com

1.4 Document Information

Revision History

Revision Level / Date	Section Affected	Description
4.1 / January 2011	Entire Document	Rotem template
4.2 / March 2011	Addendum	Added Breeder addendum
4.3 / Sept 2012		Israel address
4.4 / Jan 2013	5.6/5.12	Changed the table parameters
4.5 / Feb 2013	11	Update to include 8.08 and 8.09 features
4.6 / May 2013	11.2 / 12.1	Corrected Variable 45 / Added fogger feature
4.7 / July 2013	9.4	Changed test
4.8 / August 2013	Various sections	Changes to text
4.9 / Feb 2015	Various sections	8.11
5.0 / May 2015	2.2.4.4	Editied section

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2 GENERAL

- Features
- Principles, Options, Operation

2.1 Features

- 12 output relays (AC-2000 SE)
- 20 output relays (AC-2000 Plus)
- Optional relay extension box of up to 16 additional relays
- Up to six temperature sensors
- Up to two electronic humidity sensors (Inside & Outside)
- Up to one CO2 sensor

NOTE: All references to the CO2 sensor refer to the AC-2000 Plus Broiler, Version 8.11 **only**.

- Variable speed output (0 to 10 volts)
- Light Dimmer (0 to 10 Volts)
- Digital pulse inputs (Water, Feed, Wind Direction)
- Unique static pressure sensor (optional)
- PC Communication
- Alarm output
- Flexibility in add-on capacity:
    - o Poultry scale
    - o Water meter

NOTE: Refer to Appendix 1: AC-2000 Breeder , page 45 regarding menus which are specific for the Breeder Edition.

2.2 Principles, Options, Operation

- Summary Ventilation Setting, page 6
- Examples: Fan Groups, Curtains, and Levels, page 7
- Heaters, page 11
- Additional Systems, page 12

2.2.1 Summary Ventilation Setting

1. Assign ventilation fans to groups. The groups may use multiple output relays, so that several outputs make up a group. Different groups may not share the same relay. There is no information to enter into the control at this point. Simply write the group numbers down with the assigned fans in the installation record, **Menu 92**. The **AC-2000** uses up to 12 different groups.

2. Fill in the Ventilation Level Table, **Menu 92**. This is a part of the system installation menu, which does not appear on the front panel of the control. The **AC-2000** may use up to 20 levels.

CAUTION **Be careful to set the maximum ventilation level number correctly in configuration, Menu 91, Item 2. If the higher unused ventilation levels are at zero, the control will turn off all fans when it reaches those levels on a hot day. It is a good practice to duplicate the last line for the rest of the table.**

3. Fill in the Curtain Level Table, **Menu 95** to correspond with the Ventilation Level Table, **Menu 92**. Note that the levels in both tables correspond with each other. Fill in the Temperature Table. Choose convenient growth days, and set appropriate target, heating and cooling temperatures.

The **AC-2000** can automatically ramp these temperatures at intermediate growth dates; simply enable 'auto temp reduction,' item 6 in installation, **Menu 91**. The control will regulate the ventilation and heating equipment to maintain these temperatures.

4. Fill in the Minimum-Maximum Level Table by bird growth dates. This table limits the ventilation levels the **AC-2000** may use. The Minimum settings are your winter handle on air quality in the house.
5. Set the Target Humidity and Cooling Tables when using these systems.
6. If using static pressure controlled inlets, enter the static pressure settings.

2.2.2 Examples: Fan Groups, Curtains, and Levels

Sometimes the easiest approach is to see an example. In this section we consider two different broiler houses. One is curtain sided with cross ventilation and exhaust fans. The other has only tunnel fans. All of the fans in the first example are in the sidewalls. In the second, they are all at one end of the house.

The **AC-2000** organizes the main ventilation fans in up to 12 groups of various sizes. It turns on combinations of up to 12 of these groups at a time to provide the correct amount of ventilation.

- Example A - Typical Fan Grouping
- Example B
- Example B, Part 2
- Example B, Part 3

2.2.2.1 Example A - Typical Fan Grouping

The example here, Typical Fan Grouping with no Tunnel, Example A, demonstrates a common organization pattern. The **AC-2000** can also use a variable speed fan, and timers to cycle fans on/off.

Table 1: Typical Fan Grouping, Example A

Group 1	Fan 1 on Timer
Group 2	Fan 2 on Timer
Group 3	Fan 3
Group 4	Fan 4
Group 5	Fans 5 and 6
Group 6	Fans 7 and 8
Group 7	Fans 9 and 10

Example A uses no tunnel ventilation, but has two independent side curtains. The fans are all in the side walls. An air inlet controlled by static pressure allows minimum fresh air into the building when the exhaust fans operate. A possible ventilation table is on the next page.

Example A uses exhausts fans for minimum ventilation when the weather is cold to let the Air Inlet open by static pressure. Ventilation level 1 is for one day old chicks, and moves a minimum amount of air into the house. Level 9 has three exhaust fans going to provide air for large birds on very cold days. Levels 10 through 15 are various degrees of natural ventilation, and level 16 and above turn on more ventilation fans with Air Inlet static pressure for additional cooling during extremely hot conditions.

Table 2: Typical Ventilation Level Table, Example A

Ventilation Level	Ventilation Groups	On Min	Off Min	Diff	Var
1	1 0 0 0 0 0 0 0 0 0 0 0	0.5	4.5	0	0
2	1 0 0 0 0 0 0 0 0 0 0 0	1.0	4.0	0	0
3	1 0 0 0 0 0 0 0 0 0 0 0	2.0	3.0	0	0
4	1 0 0 0 0 0 0 0 0 0 0 0	3.0	2.0	0	0
5	1 0 0 0 0 0 0 0 0 0 0 0	1.0	0.0	0	0
6	1 2 0 0 0 0 0 0 0 0 0 0	1.0	4.0	0	0
7	1 2 0 0 0 0 0 0 0 0 0 0	2.5	2.5	0	0
8	1 2 0 0 0 0 0 0 0 0 0 0	4.0	1.0	0	0
9	1 2 3 0 0 0 0 0 0 0 0 0	1.0	0.0	0	0
10…15	0 0 0 0 0 0 0 0 0 0 0 0	0.0	0.0	0	0
16	1 2 3 4 0 0 0 0 0 0 0 0	1.0	0.0	0	0
17	1 2 3 4 5 0 0 0 0 0 0 0	1.0	0.0	0	0
18	1 2 3 4 5 6 0 0 0 0 0 0	1.0	0.0	0	0
19	1 2 3 4 5 6 7 0 0 0 0 0	1.0	0.0	0	0
20	1 2 3 4 5 6 7 0 0 0 0 0	1.0	0.0	0	0

*Natural Levels

NOTE: The above table shows one variable fan. AC-2000 Plus Broiler, Version 8.11 supports two variable fans.

NOTE: Ventilation level 6 has fan groups 1 and 2 active. The cycle timer is set at 1.0 minutes on and 4.0 minutes off. The cycle timer always applies to the highest numbered group in the ventilation level, so in this case group 1 is on steady, group 2 cycles 1.0 minute on and 4.0 minute off.

NOTE: The ***AC-2000*** displays either the On/Off minutes at each level, or the variable speed setting. It does not display both at once, although all data remains correctly in computer memory. **Menu 91**, item 3, controls which data shows on screen.

NOTE: Typical Ventilation Level Table, Example A shows 12 ventilation groups. AC-2000 Version 8.07 supports 12 groups. Previous versions support eight groups.

CAUTION Example A, repeats ventilation level 19 to level 20 (recommended for safety purposes).

Maximum ventilation level should be set to 19 in Configuration, **Menu 91**, and item 3 for this example. However, if the maximum ventilation level was at 20, with levels 20 blank, the **AC-2000** would turn off all fans at ventilation levels 20. You may duplicate these levels to prevent this, or program the maximum number of ventilation levels.

The curtain level table works with the ventilation level table.

Table 3: Curtain Level Table, Example A

Ventilation Level	Curtain 1 % Open	Curtain 2 % Open
1...9	0	0
10	15	10

Ventilation Level	Curtain 1 % Open	Curtain 2 % Open
11	25	20
12	40	30
13	60	50
14	80	70
15	100	100
16…20	0	0

Example A has two side curtains for ventilation past ventilation level 9. For this example, curtain 1 is normally to the lee side of prevailing winds. Example A has it open slightly ahead of curtain 2. If the **AC-2000** has a wind direction indicator, it automatically switches Curtain 1 and Curtain 2 levels according to the wind direction.

Referring to the **Ventilation Table**, from level 16, seven cross ventilation fans blow air across the flock for more cooling. With system variable 4 set to 15, "Maximum level when inside temperature is below cooling," the **AC-2000** will not use level 16 or above unless the temperature is above the cooling system set point. Alternatively, set the differential to account for the cooling effect and cost of these fans, as shown.

2.2.2.2 Example B: Typical fan grouping side wall and tunnel fans with static pressure control

Table 4: Typical Fan Grouping, Example B – part 1

Group 1	Fan 1 on Timer (Side Wall)
Group 2	Fan 2 on Timer (Side Wall)
Group 3	Fan 3 on Timer (Side Wall)
Group 4	Fans 4 and 5 (Tunnel)
Group 5	Fans 6 and 7 (Tunnel)
Group 6	Fans 8 and 9 (Tunnel)
Group 7	Fans 10 and 11 (Tunnel)

In Example B (Typical Fan Grouping Side Wall and Tunnel Fans with Static Pressure Contro) there is a single vent machine and a tunnel curtain machine. **All the fans are 48" tunnel fans.** The static pressure sensor controls sidewall/ceiling inlets independently from the ventilation table.

For ventilation under cold conditions, one, two or three of the tunnel fans provide minimum ventilation. These blow fresh air through the side inlets, providing uniform fresh air throughout the house. Many growers would insist on using stir fans out of safety purposes. Tunnel ventilation with cooling pads (levels 16…19) provides ventilation for large birds during hot weather.

2.2.2.3 Example B, Part 2

Table 5: Typical Ventilation Level Table, Example B – part 2

Ventilation Level	Ventilation Groups	On Minutes	Off Minutes	Diff	Var
1	1 0 0 0 0 0 0 0 0 0 0 0	0.5	4.5	0	0
2	1 0 0 0 0 0 0 0 0 0 0 0	1.0	4.0	0	0
3	1 0 0 0 0 0 0 0 0 0 0 0	2.0	3.0	0	0
4	1 0 0 0 0 0 0 0 0 0 0 0	3.0	2.0	0	0
5	1 0 0 0 0 0 0 0 0 0 0 0	4.0	1.0	0	0
6	1 0 0 0 0 0 0 0 0 0 0 0	1.0	0.0	0	0
7	1 2 0 0 0 0 0 0 0 0 0 0	1.0	4.0	0	0
8	1 2 0 0 0 0 0 0 0 0 0 0	2.5	2.5	0	0
9	1 2 0 0 0 0 0 0 0 0 0 0	1.0	0.0	0	0
10	1 2 3 0 0 0 0 0 0 0 0 0	1.0	4.0	0	0
11	1 2 3 0 0 0 0 0 0 0 0 0	2.5	2.5	0	0
12	1 2 3 0 0 0 0 0 0 0 0 0	1.0	0.0	0	0
13	1 2 3 4 0 0 0 0 0 0 0 0	1.0	3.0	0	0
14	1 2 3 4 0 0 0 0 0 0 0 0	2.0	2.0	0	0
15	4 0 0 0 0 0 0 0 0 0 0 0	1.0	0.0	0	0
16	4 5 0 0 0 0 0 0 0 0 0 0	1.0	0.0	1.0	0
17	4 5 6 0 0 0 0 0 0 0 0 0	1.0	0.0	1.5	0
18	4 5 6 7 0 0 0 0 0 0 0 0	1.0	0.0	2.0	0
19	4 5 6 7 0 0 0 0 0 0 0 0	1.0	0.0	2.0	0
20	4 5 6 7 0 0 0 0 0 0 0 0	1.0	0.0	2.0	0

Minimum Ventilation

First Tunnel

Transitional

The first part of Example B's ventilation table reflects power and transitional ventilation with air coming through static pressure controlled inlets. At level 16 the **AC-2000** switches into tunnel ventilation, with maximum fan power at level 18. Note the target temperature adjustment (for wind chill) makes by adding differential temperatures from level 16 and above.

NOTE: Typical Ventilation Level Table, Example B shows 12 ventilation groups. AC-2000 Version 8.07 supports 12 groups. Previous versions support eight groups.

2.2.2.4 Example B, Part 3

Table 6: Curtain Level Table

Ventilation Level	Tunnel Curtain % Open
1 through 14	0
15	25
16	50
17	75
18	100
19	100
20	100

NOTE: The air Inlets are controlled by pressure only. The Tunnel Curtain % sets the minimum opening if controlled by pressure

The Curtain Level Table, Example B, coordinates with the ventilation table. Note how the tunnel curtain remains open.

The **AC-2000** enters tunnel ventilation at the cooling set point, not target temperature.
System variable 21 enforces a minimum time in tunnel and out of tunnel to prevent oscillating. System variable 6 sets the degrees above target temperature to leave tunnel mode.

Tunnel ventilation begins at level 16, which one goes to **Menu 91**, Configuration **>** item 5. The side and tunnel fans operate with the vent machine until level 15. At level 16 the vents close while the tunnel curtain remains open for tunnel ventilation. Enter the time for tunnel curtain opening and closing in **Menu 91**, Configuration **>** item 10, so the **AC-2000** can account for the curtain movement rates.

2.2.3 Heaters

The **AC-2000** supports several kinds of heaters. Standard low and high-level heaters and radiant heaters work in up to six zones.

- Standard Heaters Automatic
- Radiant Heaters
- Variable Heaters

2.2.3.1 Standard Heaters Automatic

Each of the zones may have low and high-level standard heaters. The low level heaters turn on first, and if they cannot maintain the set temperature, the high level heaters turn on. For historical data collection, the **AC-2000** records the run time for the low level heaters only. It does not record the times for the high level or radiant heaters.

If you use a single zone, the **AC-2000** uses the average of the zone temperature sensors to control the heating. If using multiple zones, the **AC-2000** uses the specific zone sensor designated for each zone. Refer to **Menu 91**, (number of heating zones) and **Menu 94**.

NOTE: When the ***AC-2000*** turns on any of the standard heaters, it immediately returns to minimum ventilation.

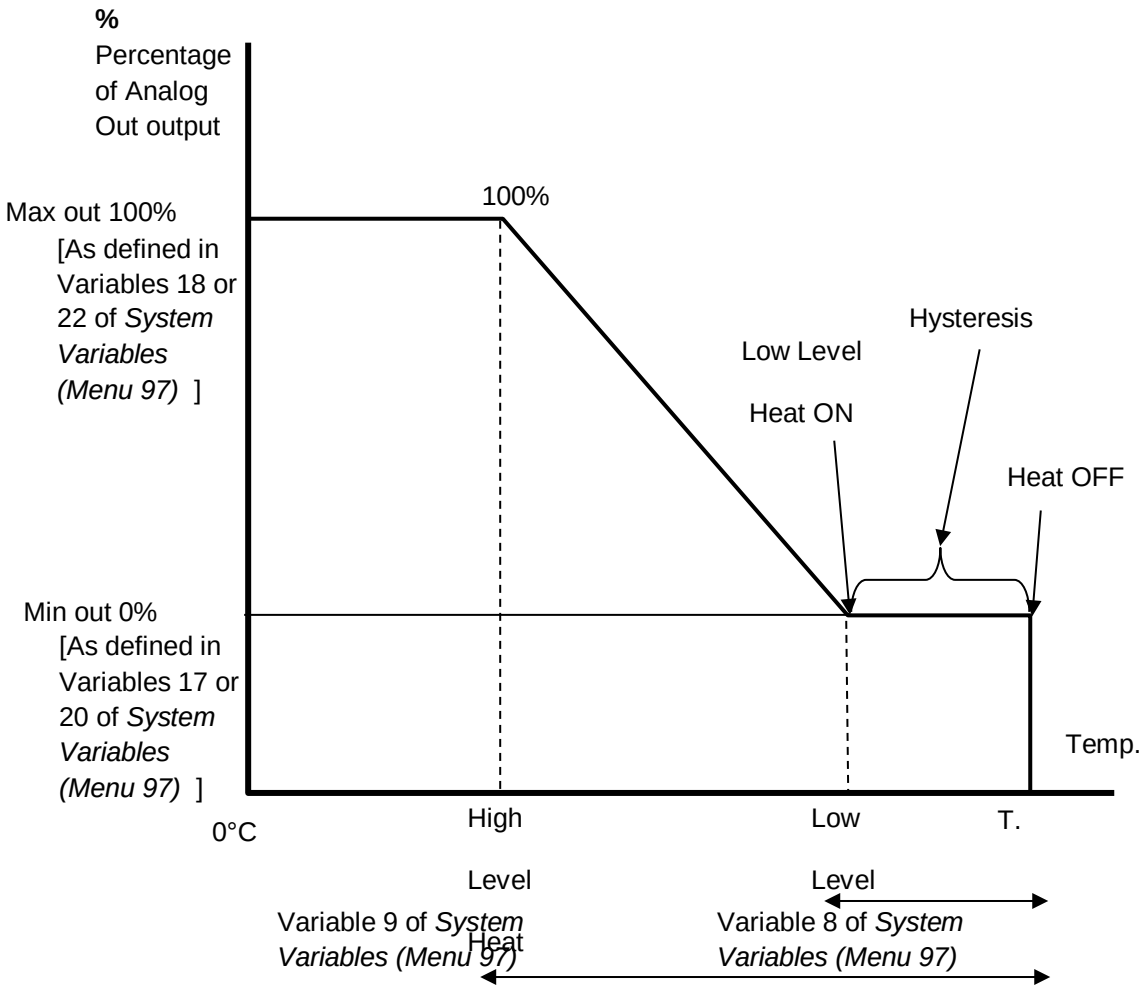
2.2.3.2 Radiant Heaters

Many brooders are of the radiant heater type. The **AC-2000** allows the radiant heaters to have individual temperature sensors to control the brooder heat.

Some radiant heaters require one relay to turn on the ignition, and another relay for the high level burner. System variable 10 sets the ignition relay on time. System variable 38 allows setting a higher set temperature for radiant heaters than the standard heaters.

2.2.3.3 Variable Heaters

NOTE: Version 8.05 and Higher support this feature.


%
Percentage of Analog Out output
Max out 100% [As defined in Variables 18 or 22 of System Variables (Menu 97)]
100%
Hysteresis
Low Level
Heat ON
Heat OFF
Min out 0% [As defined in Variables 17 or 20 of System Variables (Menu 97)]
Temp.
0°C
High Level
Low Level
T.
Variable 9 of System Variables (Menu 97)
Heat
Variable 8 of System Variables (Menu 97)

2.2.4 Additional Systems

The **AC-2000** will also run lighting, feeding and extra systems. The feeding and lighting systems may coordinate for dark-out and periodic operation. Extra systems can run according to time, temperature sensor, or cycle timer.

- Water Meter and Alarm
- Bird Scales
- Feed Overtime Alarm and Shutoff
- Wind Direction Sensor
- Remote Communication

2.2.4.1 Water Meter and Alarm

A standard pulse output water meter may be attached to the **AC-2000**. It keeps historical water consumption information, and generates alarms in the event of too little or too much water flow. A decrease in water consumption may be the first indicator of a problem with the flock, allowing corrective action before a serious situation develops.

System variable 32 sets the overtime alarm limit, variable 33 the shortage limit, and variable 34 the delay time for reporting water alarms. Use **Menu 46** to calibrate the amount of water per pulse of the water meter. Test **Menu 37** reports live counts to test the water meter; while **Menu 24** gives historical water consumption data.

NOTE: The shortage alarm applies only during 'light' conditions if the light table (**Menu 5**) turns the lights on and off. Moreover, this is disabled when water calibration is zero.

2.2.4.2 Bird Scales

The Rotem bird scale platforms can provide regular growth information on the flock. With historical information on a flock-by-flock basis, one can quickly judge actual performance of the flock. The **AC-2000** supports one or two weighing platforms.

Menu 23 provides historical bird weights, both as an average of two platforms, and individually by platform. It also includes standard deviation statistics, and number of birds weighed each day. **Menu 38** allows testing the scales by weighing objects. **Menus 43** and **44** provide calibration for either known weight or for the factory provided calibration factor.

2.2.4.3 Feed Overtime Alarm and Shutoff

If system variable 24 is one, the **AC-2000** assigns the digital input 1 to the feed overtime sensor. System variable 25 sets a delay between activation of a feed overtime alarm input, and activation of the alarm relay. System Variable 43 elects whether to shut down the feed system on an alarm.

2.2.4.4 Wind Direction Sensor

If system variable 24 is zero, the wind direction input, digital input 1, can switch the curtain level tables for curtains 1 / 2 and 3 / 4based on wind direction. System variable 19 sets the time period for the wind direction check. After each time period, the **AC-2000** averages the wind direction to either a '0' or a '1'. If the average reaches '1' (contact closed), curtains 1 / 2 and 3 / 4 ventilation table settings are switched for the next period; otherwise each curtain keeps its own settings.

2.2.4.5 Remote Communication

One of the most important capabilities of the **AC-2000** is remote communications. A personal computer may connect locally, or by modem, to a **AC-2000** almost anywhere in the world. Password protection prevents unauthorized access.

3 OPERATING INSTRUCTIONS

- Display
- Keypad
- Factory Reset (Cold Start)
- Hot keys
- Menu structure

3.1 Display

The figure below presents the **AC-2000** standard display. If an **alarm** occurs, the screen alternately shows the alarm message and this display. If the sensors are disconnected instead of temperature, "fail" will be written.

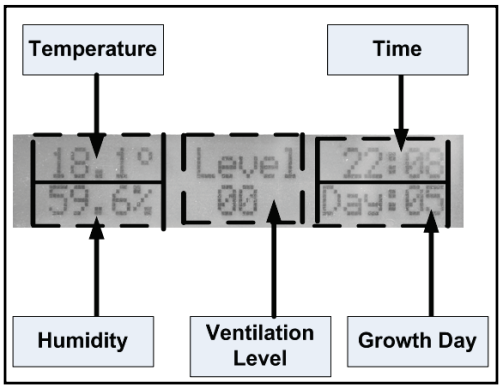


Figure 1: Standard Display

3.2 Keypad

- **MENU**: Used to display the main menu from the standard screen, and exit menus.
- **SHIFT:** In long tables press **Shift** and
  - 3 to jump up 10 steps
  - 9 to jump down 10 steps
  - 7 to go to the top of the table
  - 1 to go to the bottom of the table
- **ENTER:** Used for:
  - Going into a menu
  - Setting values such as temperatures, times, etc. This occurs only after you press the **ENTER** key
- **DEL**: Used to
  - Erase typing mistakes
  - Perform 'Cold Start' function
- **ARROW:** Navigate through menus, make selections and in some cases used for changing values.
- **NUMBERS:** Enter numbers and make choices in numbered menus.

3.3 Factory Reset (Cold Start)

To return all the data tables and settings in the control to factory fresh settings:

1. Turn controller power off.
2. Press and hold the **DEL** key and turn controller power on.
3. Keep holding the **DEL** key until ***COLD START*** appears on the screen.

3.4 Hot Keys

The **AC-2000** consists of seven hot keys for quick information.

To use the Hot Keys:

1. Go to the Main Menu.
2. Press the required key number.

The screen appears.

NOTE: The hot keys functions are available only from the Main screen.

- **Hot Key 0:** Displays the calculated wind chill temperature (see Wind Chill, page 43)

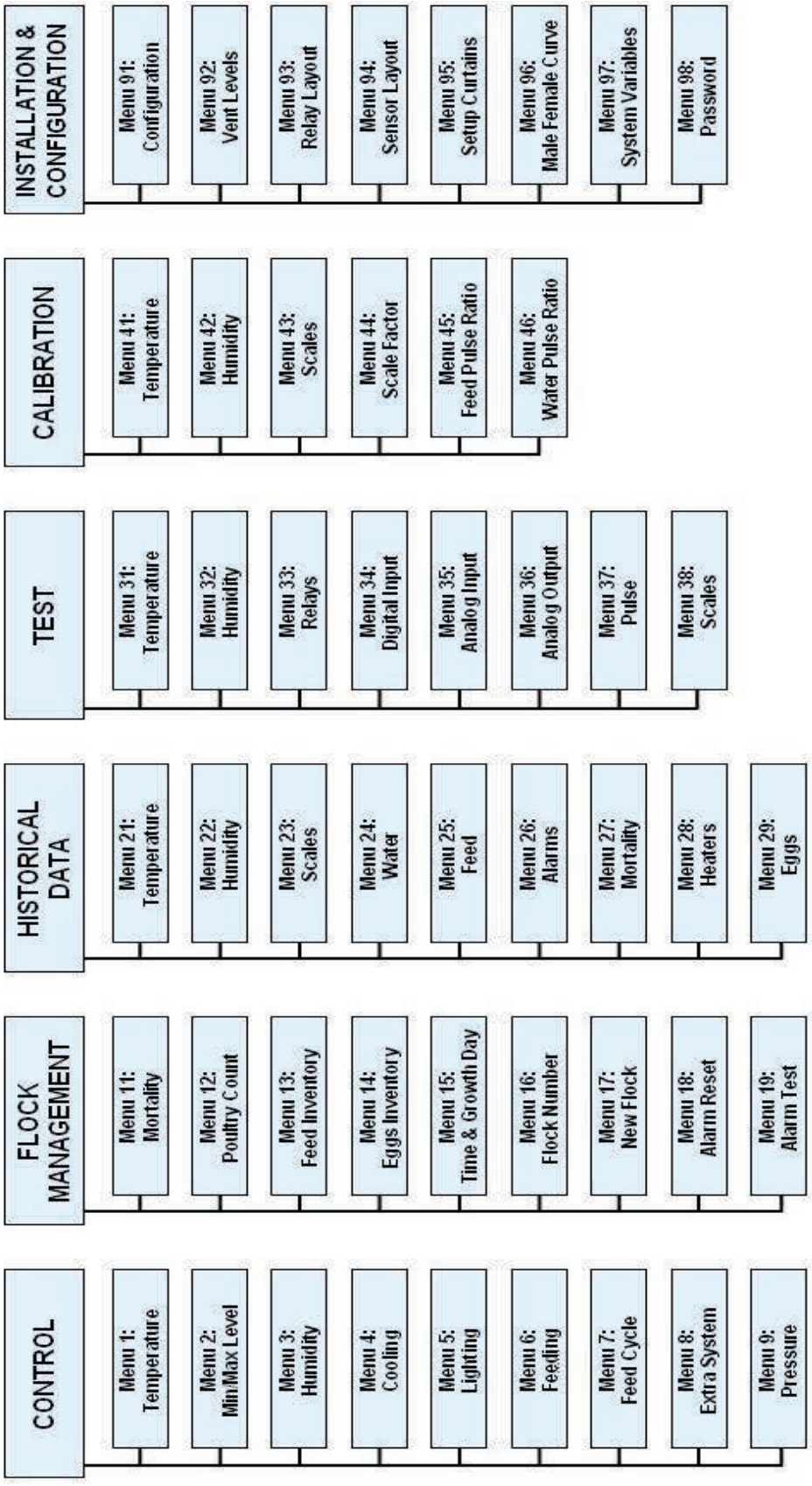
NOTE: Versions 8.09 and higher support the wind chill feature. The calculated temperature is displayed even if the wind chill feature is disabled.

- **Hot Key 1:** Displays the current target, heat and cooling (tunnel) temperature
- **Hot Key 2:** Current relay status
- **Hot Key 3:** Outside temperature, humidity, and CO2 levels
- **Hot Key 4:** Displays the temperature according to heat zones (A, B, and C)
- **Hot Key 5:** Current pressure and the pressure target

NOTE: This hot screen is not displayed unless a pressure sensor is defined in Sensor Layout.

- **Hot Key 6:** Displays the current minimum and maximum levels of ventilation
- **Hot Key 7:** Displays the temperature according to heat zones (D, E, and F)
- **Hot Key 9:** Controller's version

3.5 Menu Structure



NOTE: Version 8.07 does not support Male/Female Curve (Item 96). Menu 96 is System Variables and Menu 97 is Password. In Version 8.09, Menu 98 is Wind Chill.

4 CONTROL MENU

The following section describes how to use the Control Menu.

- Accessing menu items
- Temperature (Menu 01), page 17
- Minimum-Maximum Level (Menu 02), page 18
- Cooling (Menu 04), page 19
- Lighting (Menu 05), page 20
- Feed (Menu 06), page 21
- Extra System (Menu 07), page 21
- Static Pressure (Menu 08), page 22
- Foggers (Menu 09), page 24

4.1 Accessing menu items

```
* CONTROL MENU *
01 TEMPERATURE
```

The two digits, '01,' beside the **'TEMPERATURE'**. This number is from the Quick Menu printed on the front of the **AC-2000**, to the left of the display and keypad.

Enter any quick menu number, press the **ENTER** key to quickly reach that information. You can also browse Quick Menu items with the arrow keys. The blinking line under the '1' is the cursor. It marks the point at which your typing will appear.

With menu '**01 TEMPERATURE'** in the display, press the **ENTER** key to go into that menu.

4.2 Temperature (Menu 01)

Table 7: Temperature Menu

Day	Target	Heating	Cooling/Tunnel
1	32	30	40
7	30	28	38
14	28	26	32
21	26	23	29
28	25	21	28
35	24	18	26
42	24	16	26

Target temperatures according to bird age are included in **Menu 1**, Temperature Table. The **AC-2000** provides space for up to ten growth dates with corresponding target temperatures, heat set points and cool tunnel set points. The target temperature represents the ideal bird temperature; the heat temperature controls heater operation. The cooling set point determines the point at which the **AC-2000** switches into tunnel ventilation or uses evaporative cooling equipment.

Configuration, **Menu 91**, item 6, "automatic continues daily temperature adjustment," controls whether the **AC-2000** interpolates between lines of the temperature table, or uses the exact set points from the

table. The interpolation results in temperature ramping with smooth continuous changes, rather than sudden jumps.

4.3 Minimum-Maximum Level (Menu 02)

Growth Day	Minimum	Maximum
1	1	5
7	2	10
14	4	14
21	5	17
28	6	17
35	6	18
42	7	20
0	0	0
0	0	0
0	0	0

The Min-Max Level Table limits the **AC-2000** ventilation and curtain levels by bird age.

The **AC-2000** provides space for up to ten growth dates with corresponding minimum and maximum values. In the example above, the **AC-2000** will not exceed ventilation level 5 until growth day 6. From growth day 7 through growth day 13, the **AC-2000** uses at least ventilation level 2 (even if the heaters are on), but will not exceed level 10.

The 'Minimum' column of this table is the usual place to adjust air quality in your poultry house.

If the house requires more air, increase the minimum level. If less airflow decreases the minimum ventilation level.

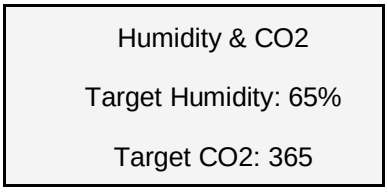
It is possible to draw a curve by using **Menu 91** both to the temperature and to the Minimum Maximum.

To set the ventilation levels:

1. In the Control Menu, press **2**.
2. Press **Enter**.
3. Type the required days and temperatures.
4. Press **Enter**.

The ventilation levels are set.

4.4 Humidity & CO2 (Menu 03)



The Humidity and CO2 menu sets the permitted relative humidity / CO2 level. When the humidity or CO2 goes above the permitted level, AC-2000 operates the treatment system.

NOTE: These functions require the relevant sensor.

To enable fresh air treatment (without a humidity sensor) set target humidity to 0%. The fresh air, humidity treatment program increases ventilation by one level if temperature is stable or slowly climbing and humidity is above target humidity.

To set the humidity and CO2:

1. In the Control Menu, press **3**.
2. Press **Enter**.
3. Type the required humidity.
4. Press **Enter**.
5. Press the down arrow.
6. Type the required CO2 level.
7. Press **Enter**.

The humidity and CO2 are set.

AC-2000 has various optional variables used to configure the humidity and CO2 parameters.

To set the variables:

1. In the Control menu, press **97**.
2. Press **Enter**.
3. Scroll down to the following variables:
    - 13: specifies the delay between increases in ventilation level to reduce humidity/CO2 or provide more fresh air
    - 27: sets the length of time to remain at the new ventilation level at each increase
    - 36: specifies the minimum temperature for humidity/CO2 treatment. This is heating temperature minus this setting.
    - 37: sets the excess humidity differential, at which the **AC-2000** uses the heaters to treat humidity.
4. After typing in the required parameters in each variable, press **Enter**.

4.5 Cooling (Menu 04)

Table 8: Cooling Menu

From Time	To Time	Tunnel Diff*	To %RH	On (Min)	Off (Min)
09:00	21:30	1.0	85.0	1	10
09:00	21:30	2.0	85.0	1	5
09:00	21:30	3.0	82.5	1	2
12:30	16:00	4.0	75.0	1	0
00:00	00:00	0	00.0	0	0

The Cooling menu defines the conditions when AC-2000 begins to reduce the temperature. Temperature reduction begins when:

- The temperature exceeds the Cooling/Tunnel set in Temperature (Menu 01) plus the Tunnel Diff.
- The humidity is less than the relative humidity set (To %RH).

For example:

- Cooling/Tunnel temperature: 33° C
- Tunnel Diff: 1.0° C

between 9:00 to 21:30, AC-2000 operates cooling pads for one minute if the temperature is above 28° C and the humidity is less than 85%. After one minute there is a 10 minute break before cooling can restart.

Additional Information

- If the temperature rises to 31° C, cooling remains on for one minute and then there is a five minute break. The **AC-2000** provides space for up to five growth days.
- **Tunnel Diff** value cannot be less than -18.0° C / -32.4° F or more than 20.0° C / 36.0° F.
- The **AC-2000** automatically sorts the table in order of 'From Temperature' after you enter the data. The sorting is done according to the following order: temperature (low to high), humidity and hour.
- A line can be active only when all the following conditions are fulfilled: time, temperature and humidity.

To configure the Cooling parameters:

1. Set the Temperature settings (Temperature (Menu 01).
2. In the Control Menu, press **4**.
3. Press **Enter**.
4. Type the required parameters.
5. Press **Enter**.

The Cooling parameters are set.

NOTE: To create a negative integer, enter in the number and then press the Alt key.

4.6 Lighting (Menu 05)

Table 9: Lighting Table

Day	From Time	To Time	Intensity
1	01:00	03:00	100%
1	05:00	07:00	100%
1	05:30	03:00	20%
1	22:00	23:00	100%
7	09:00	14:00	20%
20	00:00	23:59	100%

The lighting table stores up to 50 entries during which to turn on the lights. The **AC-2000** sorts the table by 'day,' then by 'from time.' There can be several light periods each growth day. It turns lights on and off using relays, or accepts 0 to 10 Volt controlled light dimmers. In this example, the day 1 settings apply until day 7, at which time the day 7 setting supersedes it.

To configure the Lighting schedule:

1. In the Control Menu, press **5**.
2. Press **Enter**.
3. Type the required parameters.
4. Press **Enter**.

The Lighting parameters are set.

4.7 Feed (Menu 06)

Table 10: Feeding Table

From	To	Qt/animal
06:00	14:00	1.000
13:00	07:00	1.000
*	*	*

Menu 6 sets the feeding system. It can run up to ten feeding periods per day. For full feeding, set times to cover the entire day. The **AC-2000** stops delivering feed when it has supplied the amount of feed specified in Qt/bird. If this quantity is zero, the feed system will **stay off**. The **AC-2000** takes into account the mortality, initial bird population, and the feed delivery rate.

If required, the **AC-2000** sends an alarm and shuts off the feed system for feed overruns.

To configure the Feeding schedule:

1. In the Control Menu, press **6**.
2. Press **Enter**.
3. Type the required parameters.
    - Enter "**0**" to turn the system off.
4. Press **Enter**.

The Feeding parameters are set.

To send an alarm and shut of the feed system:

1. In the Control menu, press **97**.
2. Press **Enter**.
3. Scroll down to the following variables:
    - 24: enables feed overtime alarm
    - 25: enables a feed overtime alarm delay
    - 43: enable feed shutoff if feed overtime alarm is activated
4. After typing in the required parameters in each variable, press **Enter**.

4.8 Extra System (Menu 07)

Table 11: Extra System Table

System	From Time	To Time	From Temp	To Temp	On	Off	Sensor
1	00:00	23:59	0	50.0	5	5	0
2	06:35	07:00	0	50.0	0	0	0
3	04:00	20:00	25.0	50.0	1	4	5

The **AC-2000** provides three extra systems to use for various purposes. Each system has a clock time during which it runs, high and low temperature set points with selectable sensor, and a cycle timer. If the sensor is '0', the extra systems use the average temperature the ventilation system uses. To ignore temperature, enter 0 for the low, and a large temperature, such as 50.0°C for the high temperature.

4.9 Static Pressure (Menu 08)

Table 12: Static Pressure Table

Out Temp (Low): 10.0
Press (Low T): 0.12
Out Temp (High): 25.0
Press (High T): 0.08
Low Alarm: 0.01
High Alarm: 0.6
Open Stage (sec): 0
Close Stage (sec): 0
Delay (sec): 2
Hysteresis: 0.04

NOTE: Versions 8.09 and higher do not support the Open Stage, Close Stage and Delay functions.

The Static Pressure menu enables manual configuration of the controlled air inlets and Tunnel curtains in Tunnel mode to ensure proper coop ventilation. When connected to an optional static pressure sensor, the **AC-2000** automatically adjusts the air vents / inlets / tunnel for proper ventilation.

If there is no static pressure sensor, input fixed positions for curtains for the inlets (inlets only work by static pressure) and minimal tunnel openings in Menu 95. Refer to the Installation manual for information on this menu).

To configure the Static Pressure parameters:

1. In the Control Menu, press **8**.
2. Press **Enter**.
3. Configure the following parameters:
    - **Low Outside Temperature:** To prevent cold outside air from descending directly on the flock, AC-2000 mixes cooler air with warm air. This temperature setting specifies the temperature at which the **low temperature pressure set point** is in effect. The **AC-2000** will interpolate between the low and high settings. Default: 10° C.
    - **Low Temperature Pressure Set Point:** 0.12 inches of water column. The pressure set point determines the size of the window opening. The higher the pressure, the greater the mixing of cold and warm air.
    - **High Outside Temperature:** When the outside temperature is warmer, greater air flow is required; there is less of a need to mix the inside and outside air. This temperature setting specifies the temperature at which the **high temperature pressure set point** is in effect. Default: 25° C.
    - **High Temperature Pressure Set Point:** Default: 0.08 inches of water column.
    - **Low Pressure Alarm:** Default: 0.01 inches of water column.
    - **High Pressure Alarm:** Default: 0.14 inches of water column.
    - **Open Stage:** This sets the maximum length of open run time to reduce the pressure. Setting to '0' will run the vent machine all the way to reach the target. Default: 1 second.
    - **Close Stage:** This sets the maximum length of close run time to increase the pressure. Setting to '0' will run the vent machine all the way to reach the target. Default: 1 second.

- **Run Delay:** This is the delay after an open or close run to allow the house time to stabilize after a change in pressure setting. This delay allows for stabilization. System Variable 31 is a start up delay. It sets the time for validating a pressure change to prevent reacting to wind gusts. Default: 10 Seconds.
- **Hysteresis:** This sets the total dead band about the set point, in which it does not adjust the inlets. Default: 0.02 inches of water column.

4. Press **Enter**.

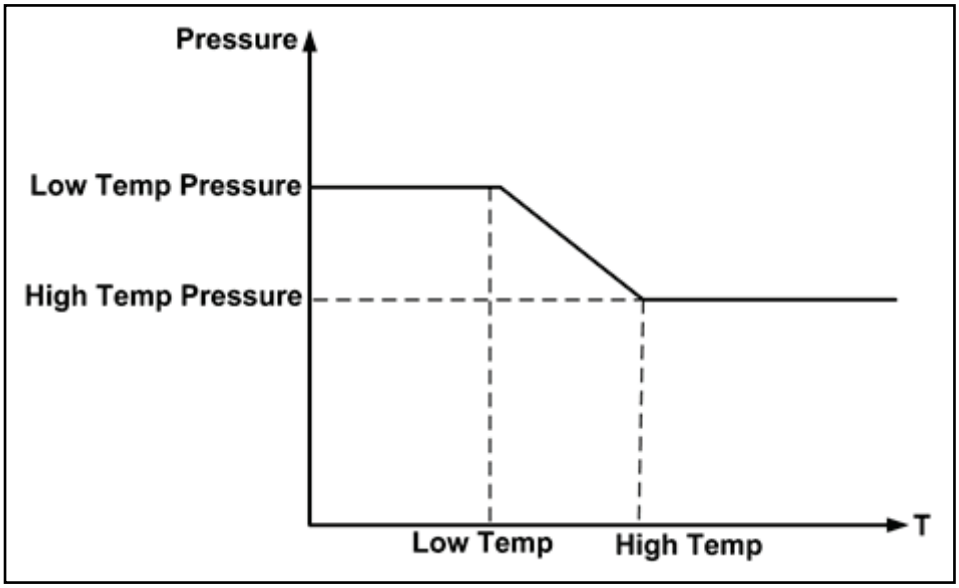
The Feeding parameters are set.

AC-2000 has various optional variables used to configure the static pressure.

To set the Static Pressure variables:

1. In the Control menu, press **97**.
2. Press **Enter**.
3. Scroll down to the following variables:
   - **28:** Selects millibars, inches of water column or Pascal as the pressure unit.
   - **29:** Stops the fans during operation of the curtains. This is useful in the case of a curtain inlet that cannot move under static pressure.
   - **30:** Disables the low-pressure alarm for low ventilation levels.
   - **31:** Forces a minimum delay before responding to changes in static pressure readings. The **AC-2000** bypasses this delay during ventilation level changes and when it turns the group fans on or off.
   - **26:** Prevents momentary pressure loss from opening doors, and high pressure pulses due to wind gusts, from setting off nuisance alarms.
   - **44:** Opens inlet before fans begin operating.
4. Press **Enter**.

The Pressure parameters are set.



Parameters 1 – 4 define the pressure curve according to the temperature. If a curve is not wanted, insert identical values to parameters 2 and 4.

4.10 Foggers (Menu 09)

Table 13: Foggers Menu

From Time	To Time	Trg Dif	To %RH	On (Min)	Off (Min)
09:00	21:30	-1.5	85.0	1	10
09:00	21:30	0	82.5	1	2
09:00	21:30	1	85.0	1	5
12:30	16:00	2	75.0	1	0
00:00	00:00	00.0	00.0	0	0

The Foggers menu defines the conditions when AC-2000 begins to operate foggers (Version 8.07 can operate two foggers). Fogging begins when the temperature exceeds the **Target temperature** (Table 7) plus the **Trg. Diff** parameter.

For example, if:

- The Target temperature is 25° C
- Trg. Diff is -1.5° C

between 9:00 to 21:30, **AC-2000** operates cooling pads for one minute if the temperature **is above 23.5° C** and the humidity **is less than 85%**. After one minute there is a 10 minute break before cooling can restart. If the temperature rises to 25° C and humidity drops to 82.5%, then cooling remains on for one minute and then there is a two minute break.

Additional information:

- The **AC-2000** provides space for up to five growth days.
- The **AC-2000** automatically sorts the table in order of 'From Temperature' after you enter the data. The sorting is done according to the following order: temperature (low to high), humidity and hour.
- A line is active only when the time, temperature and humidity conditions are met.

NOTE: Version 8.07 supports two foggers; previous versions support one fogger.

To configure the Fogging parameters:

1. Set the Temperature settings (Temperature (Menu 01), page 17.
2. In the Control Menu, press **9**.
3. Press **Enter**.
4. Type the required parameters.
5. Press **Enter**.

The Fogging parameters are set.

NOTE: After entering the Trg Dif parameter, press **Alt** to make the number a negative factor (if required).

5 FLOCK MANAGEMENT

- Mortality (Menu 11)
- Poultry Count (Menu 12)
- Feed Inventory (Menu 13)
- Time / Growth Day (Menu 14)
- Flock Number (Menu 15)
- New Flock (Menu 16)
- Alarm Reset (Menu 17)
- Alarm Test (Menu 18)

5.1 Mortality (Menu 11)

Add Mortality	0
Daily Sum	12
Add Culled	0
Daily Culled	2

Enter female/male mortality counts to keep the flock count current.

To update the Mortality figures:

1. n the Control Menu, press **11**.
2. Press **Enter**.
3. In the Add Mortality or Add Culled fields, type the required numbers.
4. Press **Enter**.

The numbers are updated. The next time that you open this menu, the new totals appear.

5.2 Poultry Count (Menu 12)

Initial count	10,000
Updated count	9988

Enter the bird population when you receive a new flock. As you enter daily mortality counts, the **AC-2000** maintains your estimated bird population under updated count. The feeding system (**Menu 6**) uses these numbers for restricted feeding schedules.

To set the Poultry Count number:

1. In the Control Menu, press **12**.
2. Press **Enter**.
3. Enter the bird population when you receive a new flock.

NOTE: If the poultry count becomes zero, the feeding system automatically stops operations.

5.3 Feed Inventory (Menu 13)

Feed supply	1000
Feed inventory	5000

The **AC-2000** provides a convenient feed inventory.

To update the Feed Inventory figures:

1. In the Control Menu, press **13**.
2. Press **Enter**.
3. Each time feed arrives; enter the quantity in the Feed supply field.

The Feed inventory field (which shows the remaining supply) is updated automatically.

4. If required, edit the Feed Inventory field.
5. Press **Enter**.

5.4 Time / Growth Day (Menu 14)

The Time/Growth day menu displays and edits the current time and growth day. Various **AC-2000** functions use these specifications.

The growth day works with the ventilation tables to change the settings as your birds grow. Normally the new flock function, **Menu 16**, sets the growth cycle day.

The internal clock uses a precision crystal, and should rarely need adjusting. The time is in 24-hour format.

To update the Time/Growth specification:

1. In the Control Menu, press **14**.
2. Press **Enter**.
3. Edit the day and time.
4. Press **Enter**.
5. The number set here is the first feed cycle day and if changed the cycle begins again from this day

Edit the growth day for the present flock if needed. Day of Cycle is the feed cycle day.

5.5 Flock Number (Menu 15)

Use **Menu 15** to enter the flock number. This number saves the management information for each group separately in your personal computer.

5.6 New Flock (Menu 16)

The New Flock menu determines if a new flock has entered the system. When a new flock is entered, **AC-2000** begins using the ventilation settings for growth day 1, and collect new management data for the new flock.

To enter a new flock:

1. In the Control Menu, press **16**.
2. Press **Enter**.
3. Type **1** for to register a new flock.
4. Press **Enter**.

AC-2000 begins a new growth cycle, erases the old management data, and sets the date in Menu 14 to 1.

5.7 Alarm Reset (Menu 17)

The Alarm Reset menu cancels all AC-2000 alarms. The reset function enables you to clear the alarm relay (code 40). You can clear the alarm relay to silence the alarm siren or bell, while working on the problem.

To cancel alarms:

1. In the Control Menu, press **17**.
2. Press **Enter**.
3. Select:
   - 0: cancel
   - 1: reset alarm siren relay only
   - 2: reset all alarms and message. These return after a period of time (see System Parameter 16, page 37)
4. Press **Enter**.

5.8 Alarm Test (Menu 18)

The Alarm Test menu enables testing the alarms at a specific time and for a specific of time.

To test alarms:

1. In the Control Menu, press **18**.
2. Press **Enter**.
3. Type the required time and length.
4. Press **Enter**.

6 HISTORICAL DATA

- Temperature (Menu 21)
- Humidity (Menu 22)
- Scales (Menu 23)
- Water (Menu 24)
- Feed (Menu 25)
- Alarms (Menu 26)
- Mortality (Menu27)
- Heaters (Menu 28)

6.1 Temperature (Menu 21)

Table 14: Sample Temperature History

Day	Min.	Avg.	Max.
*	*	*	*
20	25.0	25.5	26.5
21	24.5	25.8	26.5
*	*	*	*
Today	23.0	24.3	26.0

Menu 21 displays the minimum, average and maximum temperature history from Growth Day 1 to the current growth day. The controller calculates a true continuous average over the entire 24-hour period for each day. These data points used for the calculations are the average of the zone sensors.

6.2 Humidity / CO2 (Menu 22)

Menu 22 displays the minimum, average and maximum humidity and CO2 history from Growth Day 1 to the current growth day. The controller calculates a true continuous average over the whole 24-hour period using the average of the zone humidity sensors.

NOTE: Press the **left/right** arrow keys to navigate between the Humidity and CO2 menus.

6.3 Scales (Menu 23)

Day	Avg.	Count	S.D.
*	*	*	*
20	1.234	58	0.023
*	*	*	*
today	*	*	*

Menu 23 shows the flock weight history by growth day. This data is only displayed if you have one or two optional bird scales. For each growth day, the **AC-2000** shows the average weight, the number of birds weighed, and the standard deviation. If you have two scales, the display of the combined statistics is shown first.

- Use the left/right arrow keys to view the male/female/total data

- Use the up/down arrow keys to move forward and backwards through the growth days.

Using the communication software, it is possible to view additional statistics.

6.4 Water (Menu 24)

Menu 24 shows the daily water consumption, with percent change from the previous day for each growth day. Use the up/down arrow keys to move forward or backwards to see other growth days.

6.5 Feed (Menu 25)

Menu 25 shows the daily feed consumption, with percent change from the previous day for each growth day. Use the up/down arrow keys to move forward or backwards to see other growth days.

6.6 Alarms (Menu 26)

Table 15: Alarms Codes

Code	Alarm
1	Low Temperature
2	High Temperature
3	Temp. Failure, Zone A
4	Temp. Failure, Zone B
5	Temp. Failure, Zone C
6	Feeder Overtime
7	Low Static Pressure
8	High Static Pressure
9	Water Overflow
10	Water Shortage
11	Sensor Failure, Zone D
12	Sensor Failure, Zone E
13	Sensor Failure, Zone F
14	Alarm Test
15	Incompatible card
16	Pressure Failure

Menu 26 displays the alarms history. The AC-2000 stores the last 99 alarm events with growth date, time and alarm codes. The table above shows the meaning of each alarm code. To silence the alarm refer to **Menu 17**

6.7 Mortality (Menu 27)

Menu 27 allows you to review the mortality history. The **AC-2000** shows the present growth day data first. To view other growth days, use the up and down arrow keys.

6.8 Heaters (Menu 28)

Menu 28 shows the on time for the low level heaters in each zone. The values are in minutes for each growth day. Note that the **AC-2000** maintains heater on times only for heaters with relay codes 9, 11 and 13. If you run your heaters with other relay codes, their time will not be recorded.

7 TEST MENU

- Temperature (Menu 31)
- Humidity / CO2 (Menu 32)
- Relays (Menu 33)
- Digital Inputs (Menu 34)
- Analog Input (Menu 35)
- Analog Output (Menu 36)
- Pulse (Menu 37)
- Scales (Menu 38)

7.1 Temperature (Menu 31)

Menu 31 shows the individual readings of the temperature sensors. The **AC-2000** averages the zone sensors (see Sensor Layout, **Menu 94**) to determine the house temperature for ventilation.

- A disconnected sensor shows **DIS.**
- A shorted sensor shows **SHR.**

7.2 Humidity / CO2 (Menu 32)

Menu 32 shows the individual readings of each humidity or CO2 sensor. See Analog Inputs, **Menu 35**.

7.3 Relays (Menu 33)

The Relays menu turns individual relays on and off.

To change the Relay status:

1. In the Control Menu, press **33**.
2. Press **Enter**.
3. Move the cursor to the relay number.
4. Press **Enter**.

NOTE: See Manual Relay Operation in the installation section for a method of extending manual relay operation to arbitrarily long times.

7.4 Digital Inputs (Menu 34)

The Digital Inputs menu displays the status of the following digital inputs:

- Wind direction/Feed overtime alarm (depending on the card installed)
- Feed pulse system

The displayed value shows the input open or shorted state.

- 1: Short
- 0: Open

7.5 Analog Input (Menu 35)

The Analog Input menu displays the humidity/static pressure/CO2 analog inputs. The values shown represent the internal digital numbers used by the **AC-2000**. The **AC-2000** calculates actual values using calibration factors and other formulas for humidity or static pressure.

NOTE: The (p) column displays the A/D values of the internal pressure sensor and not on the analog inputs.

7.6 Analog Output (Menu 36)

The Analog Output menu controls a variable speed fan and a light dimmer via the activation voltage. The menu activates them at the same time.

To change the change the activation voltage:

1. In the Control Menu, press **36**.
2. Press **Enter**.
3. Type the approximate output voltage.
4. Press **Enter**.

AC-2000 checks the variable speed fan and the light dimmer at this voltage.

7.7 Pulse (Menu 37)

Menu 37 shows the current pulse count.

7.8 Scales (Menu 38)

This menu allows testing the scales. Place a known weight on the scale; the value will show in the display.

NOTE: The internal algorithms that check for stable bird weights may cause the tare to reset while weighing multiple birds. This will not cause the readings to be off since the ***AC-2000*** keeps track of the number of birds on the scale. The display will change after a brief delay, when a bird gets off, or a new one gets on. If the bird remains stable on the scale, the display will change to zero. Then, if it comes off the scale, the display will show the negative value of its weight

8 CALIBRATION MENU

The following menus are used to calibrate **AC-2000** sensors.

- Temperature (Menu 41)
- Humidity / CO2 (Menu 42)
- Scales (Menu 43)
- Scales Factor (Menu 44)
- Feed Pulse Ratio (Menu 45)
- Water Pulse Ratio (Menu 46)

8.1 Temperature (Menu 41)

Menu 41 checks and calibrates each temperature sensor.

To calibrate a temperature sensor:

1. In the Control Menu, press **41**.
2. Press **Enter**.
3. Stabilize the sensors at a known temperature.
4. Type that temperature.
5. Press **Enter**.

NOTE: The calibration base value is fixed upon entering **Menu 41**. Therefore, do not enter **Menu 41** until after the sensors are at a stable known temperature.

The **AC-2000** calculates the calibration factor. The sensors are factory tested to be accurate to within 2° F. Note that the calibration is precise only at the calibration temperature. Errors tend to increase as the temperature deviates from the calibration temperature.

Instead of measuring air temperature for calibration, it may be simpler to measure the temperature of a pail of water. Air temperature changes rapidly in small regions by several degrees as air currents move, making calibration difficult.

- Ensure the water temperature is near ambient air temperature to prevent warm up or cool down while calibrating.
- Stir the water while measuring it to eliminate warmer and cooler regions.

8.2 Humidity / CO2 (Menu 42)

Menu 42 checks and calibrates each humidity sensor.

To calibrate a humidity sensor:

1. In the Control Menu, press **42**.
2. Press **Enter**.
3. Measure the current humidity using an external independent sensor.
4. Change the humidity level in the controller to match the independent sensor.
5. Press **Enter**.

- A disconnected sensor shows **DIS**. and a shorted one shows **SHR.**
- The factor value is automatic and cannot be changed.

8.3 Scales (Menu 43)

Menu 43 calibrates the bird scales.

To calibrate a scale:

1. Remove anything from the scales.
2. In the Control Menu, press **43**.
3. Press **Enter**.
4. Select the scale to calibrate.
5. Wait at least five seconds to give the **AC-2000** time to zero the scale.
6. Place a known weight of at least 100 grams on the scale.
7. Type that weight.
8. Remove the weight, and ignore the values in the display.

The scale is calibrated.

An inexpensive method of obtaining an accurate calibration weight is to weigh a grocery item at the grocery store using their calibrated, legal for trade, scales. Then use this weight to check and calibrate the scales.

NOTE: Rotem recommends using a weight of more than one kilogram.

Exit **Menu 43**, and weigh birds. The display shows internal working values rather than actual weights while weighing birds. The program for the scale keeps track of the number of birds on the scale, and may show positive or negative changes in weight in the display. It will not log a reading while the birds are moving, to prevent erroneous measurements.

8.4 Scales Factor (Menu 44)

Menu 44 configures scale calibration factor. To eliminate the need for a precise known calibration weight, Rotem calibrates the scale platforms prior to shipment. Simply enter the calibration number from the platform, using **Menu 44**.

In Menu 44 there are two columns:

- **Factor**: The calibration number which refers to the first and second plate (the number of A/D readings per one Kg./lb.).
- **Reference**: Refers to the reference weight which is updated automatically throughout the bird growth according to the Male Female curves which are defined in **Menu 96**.

NOTE: If scale is moved from one house to another, it is required to enter in once (manually) the current average weight of the house as the reference weight.

8.5 Feed Pulse Ratio (Menu 45)

Menu 45 calibrates the feed delivery measurement system.

To calibrate the delivery system:

1. In the Control Menu, press **45**.
2. Press **Enter**.
3. Select a pulse based system (**0**), or time based system (**1**).
4. Enter the pounds of feed delivered per pulse or per minute.
5. Press **Enter**.

The feeding system is calibrated.

8.6 Water Pulse Ratio (Menu 46)

Menu 46 configures the quantity that the water meter measures per pulse. Refer to your water meter instructions for this value.

Entering '0' disables all water alarms, both shortage and overflow.

8.7 CO2 (Menu 47)

AC-2000 measure CO2 levels based on an 1 – 5 VDC analog device. This menu maps the required levels to the voltage output.

To calibrate the CO2 sensor:

1. In the Control Menu, press **47**.
2. Type the required level at 1 VDC.
3. Press **Enter**.
4. Type the required level at 5 VDC.
5. Press **Enter**.
6. Type the correction factor.
7. Press **Enter**.

9 CONFIGURATION

Table 16: Configuration (Version 8.05)

91	Configuration
92	Ventilation Levels
93	Relay Layout
94	Sensor Layout
95	Setup Curtains
96	System Variables
97	Password
98	Wind Chill

Table 17: Configuration (Version 8.09 or above)

91	Configuration
92	Ventilation Levels
93	Relay Layout
94	Sensor Layout
95	Setup Curtains
96	Male Female Curve
97	System Variables
98	Password

The installation menus are not shown on the front panel of the control. They are not used in the day-to-day operation of the control, but only during initial installation. To get to these menus from the default display, press MENU, and then enter the menu number from the Installation Menu.

NOTE: For information on Menus 91 – 95 refer to the Installation Manual.

9.1 Bird Curve (Menu 96)

According to the type of flock, enter the estimated bird weight for each given growth day for the controller to know the type of bird being weighed.

NOTE: Only **Versions 8.05** and **lower** support this feature.

9.2 System Variables

The following sections details Menu 96/97, which contains the AC-2000 variables used to determine menu values.

NOTE: Versions 8.08 and above do not support Variables 29, 37, and 38.

Table 18: Menu 96 /97 Variables

Variable	Description	Default	Range
1	Target temperature hysteresis (degrees)	0.5 ºC 0.9 ºF	0.3 – 20 ºC 0.5 – 36 ºF
2	Ventilation level increase, time delay (minutes)	3	0.2 – 10 min
3	Ventilation level decrease, time delay (minutes)	1.0	0.2 – 10 min
4	Maximum ventilation level below cooling temperature	20	0 - 20 levels
5	Tunnel mode exit, amount above target (degrees)	0 °C 0 °F	0 – 20 ºC 0 – 36 ºF
6	Out temperature as difference above target temperature to enable Tunnel Mode exit (degrees)	0 °C 0 °F	0 – 20 ºC 0 – 36 ºF

Variable	Description	Default	Range
7	High temperature alarm, amount above target (degrees)	4 ºC 7.2 ºF	0 – 20 ºC 0 – 36 ºF
8	Low level heater hysteresis, amount below Heat Set temperature (degrees)	0.5 ºC 0.9 ºF	0.3 – 20 ºC 0.5 – 36 ºF
9	High level heater hysteresis amount below Heat Set temperature (degrees)	2 ºC 3.6 ºF	0 – 20 ºC 0 – 36 ºF
10	Radiant heater ignition time (sec)	60	0 – 99 sec
11	Low temperature alarm, amount below heat (degrees)	3 ºC 5.4 ºF	0 – 20 ºC 0 – 36 ºF
12	Cooling and foggers hysteresis (degrees)	0.5 ºC 0.9 ºF	0.3 – 20 ºC 0.5 – 36 ºF
13	Humidity treatment main delay (minutes)	5	0 - 99.9 min
14	Zone A, B temperature difference for re-circulation fan (degrees)	5 ºC 9 ºF	1.5 – 20 ºC 2.7 – 36 ºF
15	Curtain position calibration	1	0 - 24
16	Delay time for returning from alarm reset	30	0 - 99 min
17	Output voltage at 0 % AN-1. Choose one of four options (none, variable fan, light, variable heat) as seen in Menu 91.	3	0 – 10 V out
18	Output voltage at 100 % AN-1	10	0 – 10 V out
19	Wind direction averaging period (minutes)	30	0 - 99.9 min
20	Output voltage At 0% AN-2. Choose one of four options (none, variable fan, light, variable heat) as seen in Menu 91.	3	0 – 10 V out
21	Tunnel mode exit lockout time (minutes)	60	0 - 99.9 min
22	Output voltage at 100 % AN-2	10	0 – 10 V out
23	Minimum curtains 1+2 opening for group fans run (%)	0	0 - 99.9 %
24	Wind direction or feed overtime alarm selection for Digital Input 1: • 0 = Wind Direction • 1 = Feed Overtime Alarm	0	0-1
25	Feed overtime alarm delay (minutes)	0	0 - 99.9 min
26	Alarm relay output delay (minutes)	0.5	0 - 99.9 min
27	Humidity treatment duration (minutes)	1	0 - 99.9 min
28	Pressure units for static pressure option: • 0 = Millibar • 1 = Inch Water • 2 = Pascal • 3 = Cm. Water • 4 = Mm. Water	1 (inch water)	0 - 4

Variable	Description	Default	Range
29	Static pressure interlock (group fans off during pressure adjustment): • No = 0 • Yes = 1	0	0-1
30	Minimum level for low static pressure alarm	1	0 - 20 levels
31	Static pressure wind gust delay (seconds)	10	0 - 99 sec
32	Water Overflow alarm quantity per minute (units)	99	0 - 99 units
33	Water Shortage alarm quantity per hour (units)	0	0 - 99 units
34	Water overflow alarm delay (minutes)	10	0 - 99.9 min
35	Water overflow during dark (quantity per hour)	0	0 - 99 units
36	Humidity treatment, heater use limit (degrees)	1 ºC 1.8 ºF	0 – 20 ºC 0 – 36 ºF
37	Humidity treatment, heater use humidity start point	99.9	0 - 99.9 %.
38	Radiation heater, set point above heat (degrees)	0 °C 0 °F	0 – 20 ºC 0 – 36 ºF
39	Tunnel mode transition (minutes)	3	0 - 99.9 min
40	Absolute high temperature alarm (degrees)	50 ºC 122 ºF	0 – 50 ºC 32 – 122 ºF
41	Sunrise/sunset duration (minutes)	1	0 - 99.9 min
42	Delay time to ignore water overflow at sunrise (minutes)	10	0 - 99.9 min
43	Enable feed shutoff if feed overtime alarm: • No = 0 • Yes = 1	0	0-1
44	Advanced air inlet open (seconds)	6	0 - 99 Sec
45	Level differential high temp alarm option (degrees)	No	No/Yes
46	Percentage above reference weight (%)	30	0 - 99.9 %
47	Percentage below reference weight (%)	30	0 - 99.9 %.
48	Tare sensitivity 0-A/D to 99-A/D	12	0 - 99 A/D
49	Weighing sensitivity 0% to 100%	30	0 - 99.9 %
50	Birds weighing start time (daytime)	0	0 - 24 hours
51	Birds weighing end time (daytime)	24	0 - 24 hours
52	Rotem use		
53	Temperature change to be considered as quick drop in degrees, to reduce a level to reach below target temp (degrees)	0.5 ºC 0.9 ºF	0.3 - 20 ºC 0.5 – 36 ºF
54	Temperature change to be considered as quick drop in degrees, to reduce a level to reach above target temp (degrees)	1 ºC 1.8 ºF	0.3 - 20 ºC 0.5 - 36 ºF
55	Delay for ignition time (seconds)	10 sec	0-99 sec
56	Cool down factor (%)	0	0 - 20%

Variable	Description	Default	Range
57	Temperature differential for 2nd fogger	0	0 - 99.9
58	Operate cool pad according to average temperature or wind chill temperature	1	1 – Cool pad 0 – Average temperature

NOTE: Versions 8.07 and higher support Variable 57.

NOTE: Versions 8.09 and higher support Variable 58.

System Variable Guide

The following details the variables listed in the above table.

1. **Target Temperature Hysteresis (Degrees):** Sets the dead band above target temperature. The ventilation level increases at the target temperature plus the hysteresis, and decreases at the target temperature. *Factory default: 0.5°C / 0.9°F*

2. **Ventilation Level Increase Time Delay (Minutes):** Sets the minimum delay time before a ventilation level increase, when rising temperatures call for higher ventilation.
Factory default: 3.0 minutes

3. **Ventilation Level Decrease Time Delay (Minutes):** Sets the minimum delay time before decreasing a ventilation level, when declining temperatures call for lower ventilation.
Factory default: 1.0 minute.

4. **Max Ventilation Level Below Cooling Temp.:** Sets the maximum ventilation level the controller uses at any time the temperature is below the cooling set point. It is a convenient way of limiting the use of extra ventilation fans to a second set point, namely the cooling temperature.
Factory default: 20

5. **Tunnel Mode Exit, Amount Above Target (Degrees):** Sets the degrees above target temperature that the **AC-2000** may leave tunnel ventilation, once it has entered tunnel mode.
Factory default: 0.0°C / 0.0°F.

6. **Out Temperature as Diff. Above Target Temp. to Allow Tunnel Mode Exit (Degrees)**: Define the differential above the target temperature to permit the exiting from Tunnel Mode when the outside temperature is warmer than the inside temperature.
Factory default: 0.0°C / 0.0°F

7. **High Temp Alarm, Amount Above Target (Degrees):** Sets the degrees above the target temperature to generate an alarm. *Factory default: 4.0°C / 7.2°F*.
*See also system variables **40** and **45.***

8. **Low Level Heater Hysteresis, Amount Below Heat Set Temperature (Degrees)**: Sets the difference between heaters turned on and heaters turned off. This hysteresis is to the low side of the set point. *Factory default: 0.5°C / 0.9°F*

9. **High Level Heater Hysteresis:** Set the relative temperature difference for high-level heaters, or amount below the heat set temperature to turn on high-level heaters.
Factory Default: 2.0°C / 3.6°F

10. **Radiant Heater Ignition Time:** Sets the length of time the radiant heater ignition is held on.
*Factory default: 60 seconds (See also System Variable **55**)*

11. **Low Temp Alarm, Amount Below Heat (Degrees)**: Sets the degrees below the Heat Temperature to generate an alarm. *Factory default: 3.0°C / 5.4°F*

12. **Cooling and Foggers Hysteresis:** Sets the difference between cooling system turned on and cooling system turned off temperatures. *Factory default: 0.5°C / 0.9°F*

13. Humidity Treatment Main Delay (Minutes): Sets OFF time for the humidity treatment cycle.
Factory default: 5 minutes

14. **Zone A, B Temp Diff. for Re-circulation Fan (Degrees):** Sets the temperature difference between Zone A and Zone B, at which the re-circulation fans turn on.
Factory default: 5.0°C / 9.0°F

15. **Curtain Position Calibration. 0-24 Times a Day:** Set the number of times in a day you would like to run a curtain position calibration (If you set this variable to 2, the controller will calibrate every 12 hours; 3-every 8 hours; etc.) The calibration program runs the curtain to the

nearest of fully open or fully closed positions. The duration of the calibration is the same as the time taken to go fully open or fully closed, as entered in configuration, **Menu 91**.

16. **Delay Time for Returning from Alarm Reset (Minutes):** If the alarm after a reset is not solved during the delay time set by the user, the alarm continues. If the alarm has been solved, it won't continue any longer. *Factory default: 30 minutes*

17. Output Voltage At 0 % AN-1: Set analog output minimum voltage level. The analog output is defined as one of four options. *Factory default: 3.0*

18. Output Voltage At 100 % AN-1: Set analog output maximum voltage level
Factory default: 10.0

19. **Wind Direction Averaging Period (Minutes):** The **AC-2000** can switch curtain tables between curtains 1 and 2 based on wind direction. This parameter sets the period for checking average wind direction, before deciding which way the wind is blowing.
Factory default: 30.0 minutes

20. **Output Voltage At 0% AN-2:** Set analog output minimum voltage level. The analog output is defined as one of four options. *Factory default: 3.0 volts*

21. **Tunnel Mode Exit Lockout Time (Minutes)** Sets the minimum time the **AC-2000** remains locked in Tunnel Mode after entering Tunnel Mode.
Factory default: 60.0 minutes

22. **Output Voltage At 100 % AN-2**: Set analog output maximum voltage level
Factory default: 10.0 volts

23. **Minimum Curtains 1+2 Opening for Group Fans Run (%):** Exhaust fans may create static pressure pulling the curtains against the house when they are almost closed. Set the point to which you want the fans to stop when the curtains move. The **AC-2000** uses the sum of curtain 1 and curtain 2 openings to determine whether to turn the fans off briefly while moving the curtains.
Factory default: 0%

24. **Wind Direction/Feed Overtime Alarm Input Selection:** Setting this to 1 makes the second digital input function as feed overtime alarm input. If it is 0, the second digital input causes the **AC-2000** to use it as a prevailing wind direction indication.

25. **Feed Overtime Alarm Delay:** Set the amount of time in minutes to wait before alarms are activated (prevents tripping on short alarms). *Factory default: 0.0 minutes*
Requires activation of the Feed Overtime Alarm (see System Variable **24).*

26. **Alarm Relay Output Delay (Minutes):** This delay applies to all alarms, except of the Feed Overtime Alarm (*See system variables **24** and **25***). The alarm relay activates after this delay.
Factory default: 0.5 minutes

27. **Humidity Treatment Duration (Minutes)**: Set the ON time for the Humidity Treatment cycle.
Factory default: 1 minute

28. **Pressure Units for Static Pressure Option: Factory default**: 1 – "Inches of water column"

Input #	Unit
0	Millibar
1	Inches of water column
2	Pascals
3	Cm. Water
4	Mm. Water

29. **Static Pressure Interlock:** Factory default is NO interlock or code '**0**'. A code of '**1**' turns on the static pressure interlock, which turns off all ventilation groups during static pressure adjustment.

30. **Minimum Level for Low Static Pressure Alarm**: Factory default of '1' allows low static pressure alarms at all ventilation levels.

31. **Static Pressure Wind Gust Delay (Seconds):** Length of time of delay before making pressure adjustments to unexpected pressure changes. *Factory Default: 10 seconds.*
See **Menu 8 for other parameters related to static pressure operation.*

NOTE: The ***AC-2000*** bypasses this delay for ventilation level changes and cycle timer fans, since it knows that the pressure change is not due to a wind gust.

32. **Water Overflow Alarm Quantity per Minute (Units):** Sets the water quantity per minute from the water meter that will trigger an overflow alarm. Calibration **Menu 46** scales the quantity, so enter the scaled quantity instead of the number of pulses from the water meter. *Factory default: 99*

33. **Water Shortage Alarm Quantity per Hour (Units):** Sets the minimum water quantity per hour that the **AC-2000** must detect to prevent generating a water shortage alarm. Note that the lights must be on during the time this alarm can occur. The **AC-2000** recognizes that birds don't drink in the dark, and disables the alarm during lights out. *Factory default: 0*.

34. **Water Overflow Alarm Delay (Minutes):** Sets the minimum amount of time that water overflow must be active before the **AC-2000** generates an alarm.
Factory default: 10.0 minutes.

35. **Water Overflow During Dark (Quantity per Hour):** Sets the water quantity per Hour from the water meter that will trigger an overflow alarm when it is **dark**. *Factory default: 0*

36. **Humidity Treatment, Heater Use Limit (Degrees):** Sets the number of degrees above the target temperature at which humidity treatment with the heaters stops.
Factory default: 1.0°C / 1.8°F

37. **Humidity Treatment, Heater Use Humidity Start Point:** Sets the relative amount above requested humidity at which heater use to reduce humidity begins. *Factory default: 99.9%* (disabled)

38. **Radiation Heater, Set Point Above Heat. (Degrees):** This is the relative number of degrees above heater set point, at which the radiant heaters turn on. They stay on for all temperatures below this. *Factory default: 0.0°C / 0.0°F*

39. **Tunnel Mode Transition (Minutes):** This parameter determines when to transit to Tunnel mode. During this time, the Tunnel curtain opens and neither pressure control nor pressure alarm occur, even if the pressure is low. After half of the time set, Inlet closing occurs. At the end of this time, the controller begins pressure control and returns to dealing with the pressure alarms. For example, if the time defined is 3.0 minutes, the Tunnel open occurs during all these 3.0 minutes. After 1.5 minutes Inlet Close occurs.
Factory default: 3.0 minutes

40. **Absolute High Temperature Alarm (Degrees):** Sets an absolute high temperature alarm point, which remains at the place you set it. *Factory Default: 50ºC / 122°F*

41. **Sunrise/Sunset Effect Duration (Minutes):** Sets the length of time to change light levels from one setting to another. *Factory default: 1.0 minute*

NOTE: When defining 100% sunrise, the controller reaches 0 – 100% during the time defined. If less than 100% sunrise is defined, the time will be divided according to its relative percentage.

42. **Delay Time to Ignore Water Overflow at Sunrise (Minutes):** This parameter allows an extra delay during light up. At lights up there will be this delay time to ignore water overflow.
Factory default: 10 minutes

43. Enable Feed Shutoff if Feed Overtime Alarm: Select yes (1) to turn off feed relays for feed overtime alarm. *Factory default: 0* (NO) NO = 0 YES = 1

44**. Air Inlet Open Advance (Seconds):** This is the number of seconds prior to turning on fans that the inlets will begin to open when fans cycle according to the ventilation table settings. It is significant for minimum ventilation settings, where a total run time of 0.5 minutes might not allow the inlets to get open and set before the fans turn off again. *Factory default: 6 seconds*

45**. Level Differential High Temp Alarm Option (Degrees):** This option instructs the **AC-2000** to consider the ventilation level temperature differential in the relative high temperature alarm setting. The alarm will occur at the target temperature plus the current ventilation level differential temperature plus System Variable 7. If you leave this at zero (no level differential option) the high temperature alarm occurs at target temperature plus System Variable 7. *Factory default: 0 (NO)*

- NO = 0
- YES = 1

NOTE: If there is no airflow in the house, the temperature differential from Menu 92 will cause the alarm temperature to be higher than normal. This can result in bird loss; use this option only with adequate back up and other means to ensure adequate air flow at all times.

46**. Percentage Above Reference Weight (%):** Define what percentage above the reference weight for the scale not to record. *Factory default: 30.0*

47**. Percentage Below Reference Weight (%):** Define what percentage below the reference weight for the scale not to record. These 2 parameters are entered in order to avoid illegal weightings (For example: a few birds at a time). *Factory default: 30.0*

48**. Tare Sensitivity, 0-A/D to 99-A/D:** This parameter sets the number of + and - A/D reading required for taking the Tare before taking a new weighing. Increasing this value allows taking Tare and a weight for unstable hanging platform but accuracy is decreased. (A/D reading). *Factory default: 12*

49**. Weighing Sensitivity, 0%to 100%:** Maximum weight sampling difference allowed (in %) during weighing process, to be considered as a legal weight for memory registration. Higher value will accelerate weighing speed but may reduce accuracy.
Factory default: 30%

50. **Birds Weighing Start Time (Daytime)**: *Factory default: 0.0*

51. **Birds Weighing End Time (Daytime)**: *Factory default: 24.0*

52. **Feed Cycle Length Limitation. (Days)**: *Factory default: 7 days*

53. **Temp Decrease BELOW Target for Level Decreasing (Degrees)**:

- IF:
    - The average temperature is **below** the Target Temperature
    - AND IF the Outside temperature is below the Heat Temperature (or no temperature sensor exists)
    - AND IF the average temperature drops more than this setting (*Factory default: 0.5°C / 0.9°F*) in one minute,
- ***THEN*:** the **AC-2000** decreases one level.

54. **Temp Decrease ABOVE Target for Level Decreasing (Degrees)**:

- IF:
    - The average temperature is **above** the Target Temperature
    - AND IF the Outside temperature is below the Heat Temperature (or no temperature sensor exists)
    - AND IF the average temperature drops more than this setting (*Factory default: 1.0°C / 1.8°F*) in one minute,
- ***THEN*:** the **AC-2000** decreases one level.

55. Delay ignition time (Seconds): This is the delay between ignition relay on to heater on. Default: 10 seconds.

NOTE: See also System Variable 10.

56**. Cool down Factor (%):** The minimum percentage correction towards target during each increase ventilations delay. If the temperature does not improve by this amount, the AC-2000 will increase it in one level after the delay time. Default: 15%.

57**. Temperature differential for 2nd fogger**: The second fogger stage is triggered when the temperature increases the amount set in this variable from "Cooling/Tunnel" specified in Temperature (Menu 01) (page 17). *Factory default*: 0.0. To disable this stage, set the differential to 0.0.

NOTE: Versions 8.07 or higher support a second fogger.

58**. Operate Cool Pad based on the average temperature or the calculated wind chill temperature**. *Factory default*: 1

- 1 – Cool pad
- 0 – Average temperature

NOTE: Version 8.09 supports the Wind Chill feature

9.3 Password

To protect the integrity of the **AC-2000** settings, use a password. For the communications programs to access all the **AC-2000** controls on one line, they will need to have the same password. You can enter a high password to provide complete access, and/or a low password that allows reading the information on the controller but not making changes.

9.4 Wind Chill

NOTE: Versions 8.09 and above support this feature.

AC-2000 can take into consideration the wind chill factor when making certain calculations related to the temperature. In effect, the wind chill factor acts as the temperature differential. When enabled, AC-2000 determines the "**calculated temperature** (actual temperature – wind chill temperature) and uses this temperature:

- When calculating the Tunnel Mode level up/down algorithms
- When operating the Cool Pad (if enabled in System Variables; refer to Operate Cool Pad, page 39.

The Wind Chill factor influences controller operation from the 1st tunnel level.

NOTE: The actual temperature: 1) determines the entry and exit into Tunnel Mode 2) controls the fogger.

Parameters:

- **Wind Chill**: Select '0' for no, '1' for yes. Default is '1'.
- **Cross Section** (sg.): House dimension in square meters or feet (set the unit in Menu 91).
- **Fan# 1 - 12**: The fan group capacity in square meters or square feet per minute.
- **Wind Chill Limit**: Maximum wind chill factor value. Default = 8° C.
- **RH Effect**: The decrease in temperature caused by an increase in relative humidity. Default is 0.26° C. Refer to the following section for details.

9.4.1 Relative Humidity Effect

The Relative Humidity Effect parameter enables including the relative humidity (RH) in the wind chill factor calculations. A rise in relative humidity reduces the wind chill factor. How does it work?

- There is no effect below 40% relative humidity.
- The user determines the increase in temperature for every 5% increase in relative humidity.
    - The default increase is 0.26° C; meaning that between 40.1% - 45% relative humidity, the wind chill factor **decreases** by 0.26° C. Between 45.1% - 50%, the wind chill factor decreases by 0.52° C, twice the default level. Between 50.1% - 55%, the decrease is 0.78° C, three times the default level, and so on.
    - The user can set the temperature increase as required.
    - To disable this feature, enter '0'.

9.4.2 Example of Wind Chill Factor and Relative Humidity Effect

A farmer sets up the Wind Chill features as follows:

- Wind Chill factor: 8° C
- Relative Humidity effect: 0.5° C

At 35° C, the calculated temperature is: 35 – (Wind Chill factor - RH effect). For example, if the relative humidity is 52%, the calculated temperature is: 35 – (8 - 1.5) = 28.5° C. Table 13 lists the calculated temperatures according to the input factos.

Table 19: Calculated Temperatures

RH (%)	Actual Temperature	Wind Chill Factor	Relative Humidity Effect	Calculated Temperature
0 - 40	35	8	0	27
40.1 - 45	35	7.5	0.5	27.5
45.1 - 50	35	7	1	28
50.1 - 55	35	6.5	1.5	28.5
55.1 - 60	35	6	2	29
60.1 - 65	35	5.5	2.5	29.5
65.1 - 70	35	5	3	30
70.1 - 75	35	4.5	3.5	30.5
75.1 - 80	35	4	4	31
80.1 - 85	35	3.5	4.5	31.5
85.1 - 90	35	3	5	32
90.1 - 95	35	2.5	5.5	32.5
95.1 - 100	35	2	6	33

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10 APPENDIX 1: AC-2000 BREEDER

The following menus are related to the AC-2000 Breeder edition.

10.1 Breeder menus

1. Feed cycle, Menu 7

- The feed cycle has up to 7 days. The number of days is set in menu 97- system variables, variable 52. For example: If variable 52 is set on 4, the number of days in the cycle will be 4.
- In Flock Management menu, table 15- Time & growth Day, use the arrow keys and move to the day of cycle number, this number will indicate the first day cycle.
- In the status line set either 0 for no feed (skip day) or 1 for feed.

2. Poultry count, Menu 12

- The count is being made for male and female separately. Enter the bird population when you receive a new flock. As you enter daily mortality counts, the **AC-2000** will maintain your estimated bird population under updated count.
- The feeding system (Menu 6) uses these numbers for restricted feeding schedules.

NOTE: If the poultry count becomes zero, the feeding system will automatically stop operation.

3. Eggs Inventory, Menu 14

- Enter Egg counts to the add eggs line at any time of the day, and the **AC-2000** will total them in the daily egg counts line.
- The controller will do the same for hatchings.
- If you only enter the quantity once per day, you can put it directly in the daily line.

4. Time and growth day, Menu 15

- The internal clock uses a precision crystal, and should rarely need adjusting. Various functions, such as the cooling table and the curtain position calibration function use the internal clock. The time is in a 24-hour format.
- Edit the growth day for the present flock if needed. Normally the new flock function, menu 17, sets it. The growth day works with the ventilation tables to change the settings as your birds grow.
- Day of Cycle is the feed cycle day. The number set here is the first feed cycle day and if changed the cycle will begin again from this day.

5. Male, female curve, Menu 99

- According to the flocks, enter the estimate male/female weight for each given growth day for the controller to know the type of bird being weighed.
- Reference weight for male and female (breeders) is calculated from the table. The weight is changed every moment. The day can be changed by up and down arrows.

NOTE: The Breeder Version 8.07 supports Bird Curve (refer to Bird Curve (Menu 96), page 36). Version 8.10 supports two foggers (refer to Foggers (Menu 09) page 24).

10.2 Extra AC-2000 Breeder system variables

NOTE: Tunnel curtain with static pressure (codes-42, 43) does not exist.

Variable	Description	Default	Value
46	Percentage Above Female Reference Weight	15	
47	Percentage Below Female Reference Weight	15	
48	Percentage Above Male Reference Weight	15	
49	Percentage Below Male Reference Weight	15	
50	Weight start time (0-24)	0	
51	Weight end time (0-24)	24	
52	Feeding day cycle	7	

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ROTEM®
Control & Management

AC-2000 Plus and AC-2000 SE

Poultry Controllers

Installation Manual

P/N: 110050

www.rotem.com

Take Control®

Warranty & Limitation Of Liability

1. ROTEM warrants that the product shall be free of defects in materials or workmanship and will conform to the technical specification for a period of 1 (one) year from the date of initial installation on site (the "warranty period").

2. ROTEM warrants that during said warranty period, any item/items or part/parts of equipment found defective with respect to materials or workmanship or which do not conform to the technical specification shall be repaired or replaced (at ROTEM's sole discretion), free of charge.

3. During the warranty period, in the event of an alleged defect, authorized resellers in relevant regions should be notified as soon as possible from the date of noticing the said defect, but no longer than thirty (30) days from such a discovery. The report shall include (1) a short description of the defects noticed (2) type of card / component and its matching serial number.

4. ROTEM's sole liability under this warranty is the repair or replacement of the defective item of product.

5. Load cells are not covered by ROTEM’s warranty.

Conditions and Limitations

1. ROTEM will not be responsible for any labor costs or expenses associated with replacement of defective items or other parts of the product or repair.

2. This warranty shall not cover: (i) product or part therein which has been modified (without prior written approval of ROTEM), or (ii) product or part therein which has not handled or installed by an authorized reseller of ROTEM or (iii) product or part therein which has either handled or installed not in strict accordance with ROTEM's instructions, (iv) products which were used for function other than agriculture industry.

3. This warranty will not apply in the following cases: (i) if all components of the product are not originally supplied by ROTEM (ii) the defect is the result of an act of nature, lighting strikes, electrical power surge or interruption of electricity (iii) the defect is the result of accident, misuse, abuse, alteration, neglect, improper or unauthorized maintenance or repair.

ROTEM warns and alerts all users that the Product is inherently complex and may not be completely free of errors. ROTEM's products are designed and manufactured to provide reliable operation. Strict tests and quality control procedures are applied to every product. However, the possibility that something may fail beyond our control exists. Since these products are designed to operate climate control and other systems in confined livestock environments, where failure may cause severe damage, the user should provide adequate backup and alarm systems. These are to operate critical systems even in case of a ROTEM system failure. Neglecting to provide such a backup will be regarded as the user’s willingness to accept the risk of loss, injury and financial damage.

In no event will ROTEM be liable to a user or any third party for any direct, indirect, special, consequential or incidental damages, including but not limited to any damage or injury to business earnings, lost profits or goodwill, personal injury, costs of delay, any failure of delivery, costs of lost or damaged data or documentation, lost or damaged products or goods, lost sales, lost orders, lost income.

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Software Version: **8.10 (SE) / 8.11 (Plus)**
Document Version: **3.9**

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1 FRONT MATTER

This section includes information on the manual and general information.

1.1 Introduction

Rotem manuals provide easy-to-use information regarding the installation, operation, long/short term planning and parts listing (this manual may not deal with all of the above subjects). The table of contents is an outline of the relevant information in this manual.

Read this manual before operating your Rotem product. Using this equipment for any other purpose or in a way not within the operating recommendations specified in this manual will void the warranty and may cause personal injury.

If you have any questions or comments regarding your product, please contact your local Rotem dealer.

1.2 Conventions

NOTE: Notes provide important details regarding specific procedures.

CAUTION Cautions alert you to potential damage to the controller if the procedures are not followed carefully.

WARNING! Warnings alert you to potentially hazardous situations which, if not avoided could result in death or personal injury.

1.3 Contact Information

Rotem Control and Management

Email: support@rotem.com **URL**: www.rotem.com

1.4 Document Information

Revision History

Revision Level / Date	Section Affected	Description
3.2 / Jan 2011	Front Matter	Added Front Matter
3.3 / May 2011	4.4/4.5	Added ground strip
3.4 / October 2011	4.5	Added AC-2000 Plus
3.5 / Nov 2011	4.2.6/4.3.6/4.4	Added 2 sections/ deleted 4.4
3.6 / Sept 2012	5	Ver 8.07 Sys variables corrected
3.7 / Feb 2013	4.2.3/4.3.3	Changed wiring diagram, updated to 809
3.8 / July 2014	2.4	Frequency inverters
3.9 / Feb 2015	5.2/ Appendix	8.11/CO2 sensor

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2 PRECAUTIONS

- Grounding
- Filtering
- Checking the Battery Level
- Frequency Inverters

2.1 Grounding

- Always connect temperature and sensor shields to earth ground.
- Avoid mixing high voltage wiring with sensor and low voltage wiring.
- Keep the controller as far as possible from heavy contactor boxes and other sources of electrical interference.
- Do not connect communication wire shields, which go from one house to another at both ends. Connect them at one end only. Connection at both ends can cause ground loop currents to flow, which reduce reliability.
- The COM connection for communications is not the shield wire. The COM, RX and TX wires must connect to each other at all controllers.

2.2 Filtering

If this installation includes a power inverter to drive variable speed fans, install an EMI filter in front of the inverter, according to the specifications provided by the inverter manufacturer. Refer to the inverter documentation.

2.3 Checking the Battery Level

Check the battery once a year. The output must be 2.7 volts (minimum). Authorized personnel only must replace the battery if the output is below the minimum required level or every five years.

2.4 Frequency Inverters

Frequency inverters can cause severe electrical and electromagnetic interference. Therefore, when employing a frequency inverter, it is critical that you carefully follow the manufacturer's installation instructions. In particular verify:

- that the cable shielding between the inverter and any motor meets industry standards
- proper grounding of the inverter's chassis and motor power cable
- proper grounding of low voltage cable shield wire
- that the controller and inverter cables are kept in separate conduits or wire bundles

3 TECHNICAL SPECIFICATIONS

Input Power Voltage

One Phase 115 ± 10 VAC (USA and Canada)
230 ± 20 VAC (Outside USA and Canada)
0.5 Amp, 50-60Hz

Relay Loads

5.0 Amps, 250 Volts, Fused

Analog Inputs

0 - 11 Volts, 10 Milliamps Maximum

Analog Output

0 - 10 Volts:
Current Limited with 100-Ohm Resistor

Digital Inputs

5 ma @ 5 Volts, Dry Contact

Operating Temperature Range

-10° to +50° C (14° to 125° F)

Enclosure

Water and Dust Tight

Fuses

Main fuse: 0.315 Amps, 250 Volts
Others: 5 Amps, 250 Volts

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4 INSTALLATION

This manual details the installation procedures for the **AC-2000 SE** and **AC-2000 Plus Broilers** and **Breeders**.

- Mounting the Unit, page 7
- AC-2000 Plus Wiring, page 7
- AC-2000 SE Wiring, page 12

4.1 Mounting the Unit

1. Install the **AC-2000** in a dry well lighted area, preferably in an annex to the main poultry house.

2. Mount it using the three holes provided; one in each of the left and right lower corners, accessible from the front under the terminal strip cover, and one top center in the back. The top center hole is a keyhole variety.

3. Install the screw for this hole first to about 0.1 inches of the wall surface. Then hang the control on this screw. Install the other two screws to fasten the **AC-2000**.

CAUTION **Always connect temperature and sensor shields to earth ground. However, do not connect communication wire shields, which go from one house to another at both ends. Connect them at one end only. Connection at both ends can cause ground loop currents to flow, which reduce reliability.**

CAUTION **The COM connection for communications is not the shield wire. The COM, RX and TX wires must connect to each other at all AC-2000 controls.**

CAUTION **Avoid mixing high voltage wiring with sensor and low voltage wiring.**

CAUTION **Keep the AC-2000 as far as possible from heavy contactor boxes and other sources of electrical interference.**

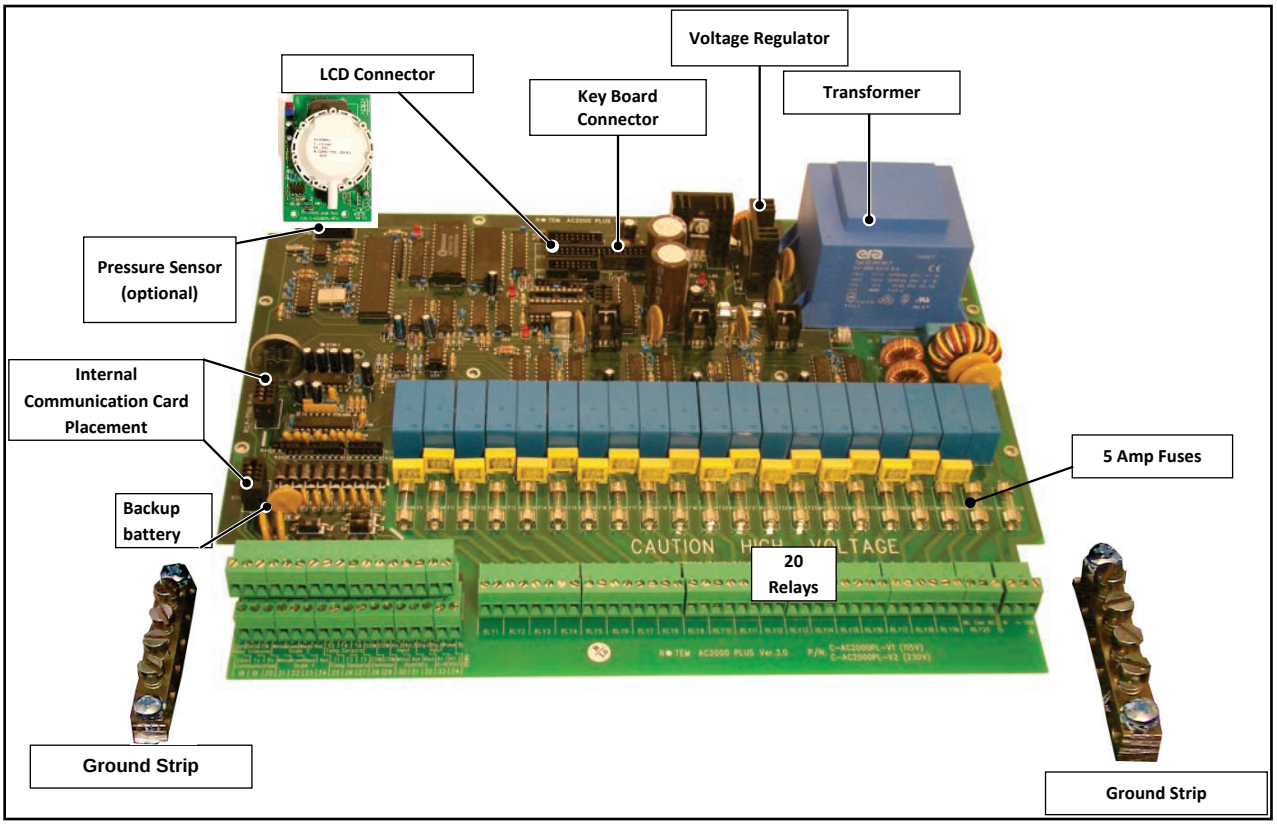
Refer to Electrical Grounding, page 26 for information on grounding the unit.

4.2 AC-2000 Plus Wiring

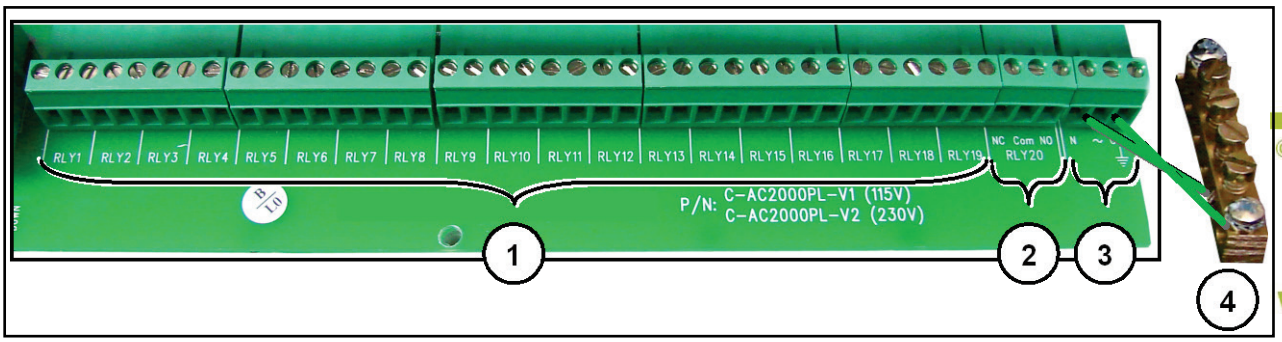
The following sections detail the AC-2000 Plus wiring.

- AC-2000 Plus Board Layout, page 8
- AC-2000 Plus Relays, page 8
- AC-2000 Plus High Voltage Wiring (Relays), page 9
- AC-2000 Plus Terminals, page 10
- AC-2000 Plus Low Voltage Wiring (Terminals), page 11
- AC-2000 Plus Communication Wiring, page 11

4.2.1 AC-2000 Plus Board Layout



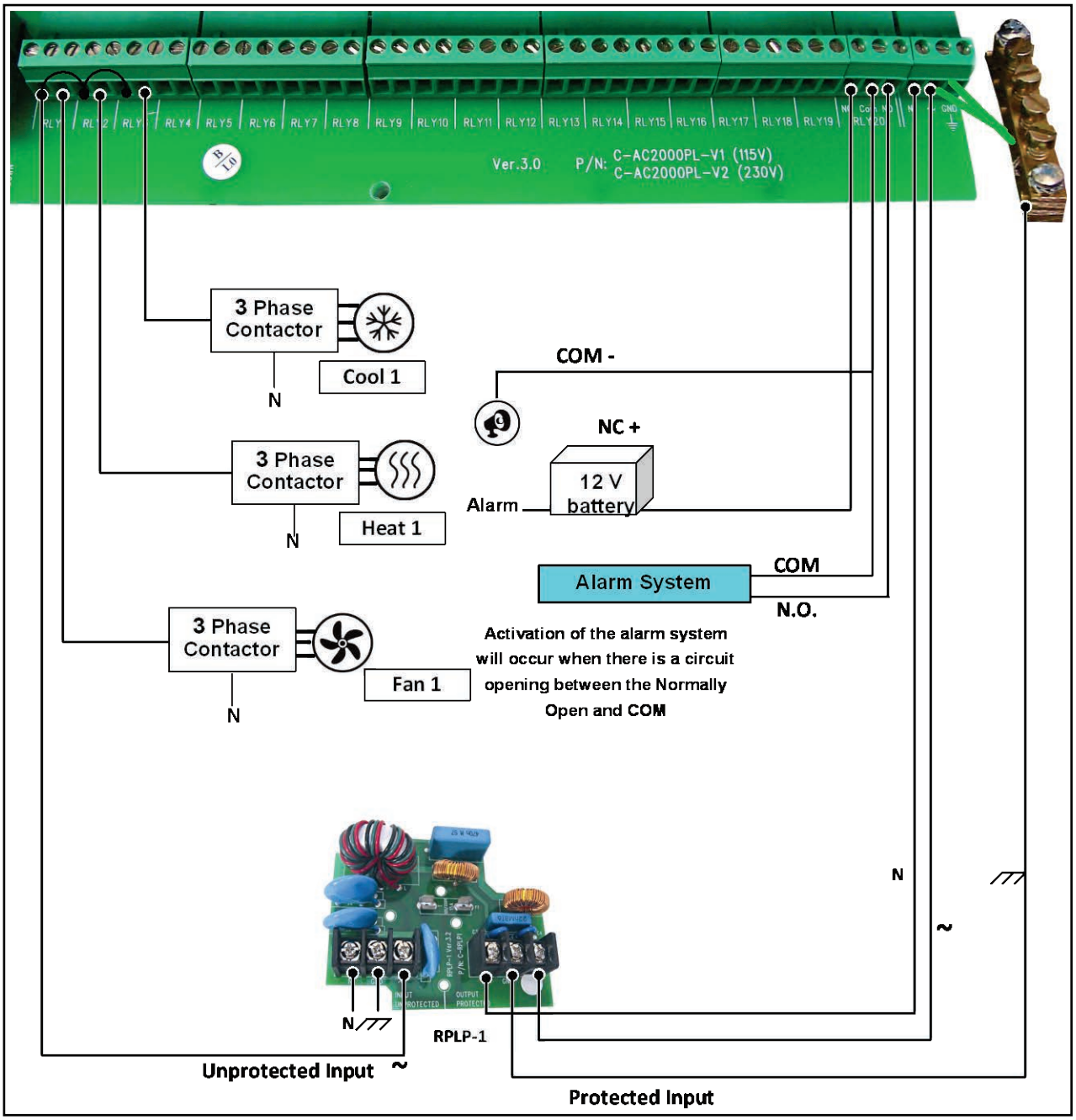
4.2.2 AC-2000 Plus Relays



Relays 1 to 19: Each pair of terminals goes to one relay. These relays are fused with a 5-ampere, 250-volt slow blow fuses. The relays are normally open when not powered.

1. **Relay 20**: Three terminal blocks: This relay normally serves as an alarm relay. It is also fused with a 5 ampere, 250 volt slow blow fuse, and can serve as an ordinary relay:
   - o **NC**: Normally closed contact
   - o **Com**: Common contact
   - o **NO**: Normally open contact
2. **Power**: Three terminal blocks:
   - o **Neutral (N)**: Connect to the Neutral Power line.
   - o **Phase (~)**: Connect to the Phase Power line.
   - o **Ground (GND)**: Connect to a solid earth safety ground, normally with the bare safety ground wire, or a green wire.
3. **Ground**: Connect the ground wire to the electrical system.

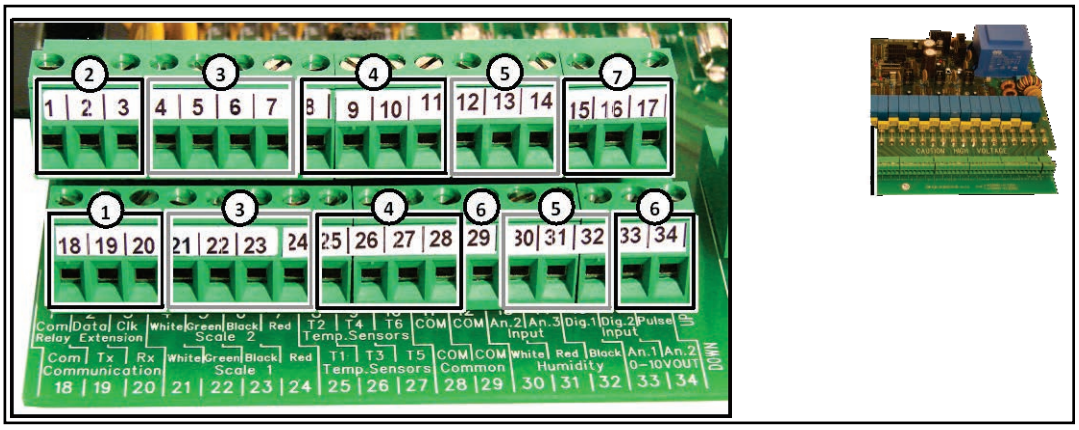
4.2.3 AC-2000 Plus High Voltage Wiring (Relays)



NOTE: The device connections (fan, heat, cool, etc.) that are shown in the drawing, are examples only!

CAUTION Connect the AC-2000 Plus power input to the protected output only!

4.2.4 AC-2000 Plus Terminals


Com Data Clk White Green Black Red T2 T4 T6 COM COM An.2 An.3 Dig.1 Dig.2 Pulse
Relay Extension Scale 2 Temp.Sensors Input Input
Com Tx Rx White Green Black Red T1 T3 T5 COM COM White Red Black An.1 An.2 COMMO
Communication Scale 1 Temp.Sensors Common Humidity 0-10VOUT
18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34

1. **Communications**: Three terminal blocks for PC communication using the optional multiplexor, **MUX-2**.
   - o **RX (20)**: Receive into **AC-2000 PLUS**. With multiple controls, connect all the RX pins together. Connect to TX at Multiplexor only.
   - o **TX (19)**: Transmit from **AC-2000 PLUS** With multiple controls, connect all the TX pins together. Connect to RX only at Multiplexor only.
   - o **COM (18)**: Ground reference for communications. Do not connect shields to this pin. Connect to COM at multiplexor also.
2. **Relay Extension**: **Com (1)** - The relay extension box such as the ***REB-8*** may be located up to 10 feet from the **AC-2000 PLUS**. Do not connect the shield to this terminal. Connect the shield to earth ground only at one end of the cable to avoid ground loops.
   - o **Data (2)**: This line carries data to the relay extension.
   - o **Clk (3)**: This line carries a clocking signal for use by the relay extension.
3. **Up To 2 Optional Bird Scales**: Connect 4 wires (white, green, black, Red) of Scale 1 to SCALE 1 terminals (21, 22, 23, 24) and 4 wires of scale 2 to Scale 2 terminals (4, 5, 6, 7).
4. **6 Temperature Sensors (8, 9, 10, 25, 26, 27)**: The temperature sensor is a 2 wired black shielded cable thermistor (RTS-2). Connect one wire to the temperature sensor terminal and the other to common **(11, 28)** *Polarity does not matter.
5. Analog Inputs:
   - o **Humidity Sensor (30, 31, 32)**: Connect according to wire colors (White, Red, Black).
   - o **An.2 (13)**: Humidity Outside Humidity input. Connect the white wire of the Humidity sensor to An.2 and the red and black together with the Humidity input red and black.
   - o **An.3 (14)**: Pressure sensor (Connect + red wire to An.3 and Black – wire to Common).
6. Analog Outputs:
   - o **An.1 (33)**: 0 to 10V- Light Intensity control signal
   - o **An.2 (34)**: 0 to 10V- Variable speed control signal
   - o **COM (29)**: Connect the common wire of An.1 & 2 to terminal 29
7. Digital Inputs:
   - o **Dig 1 (15)**: Feed overtime alarm input or wind direction selection
   - o **Dig 2 (16)**: Feed counter
   - o **Dig 3 (17)**: Water meter

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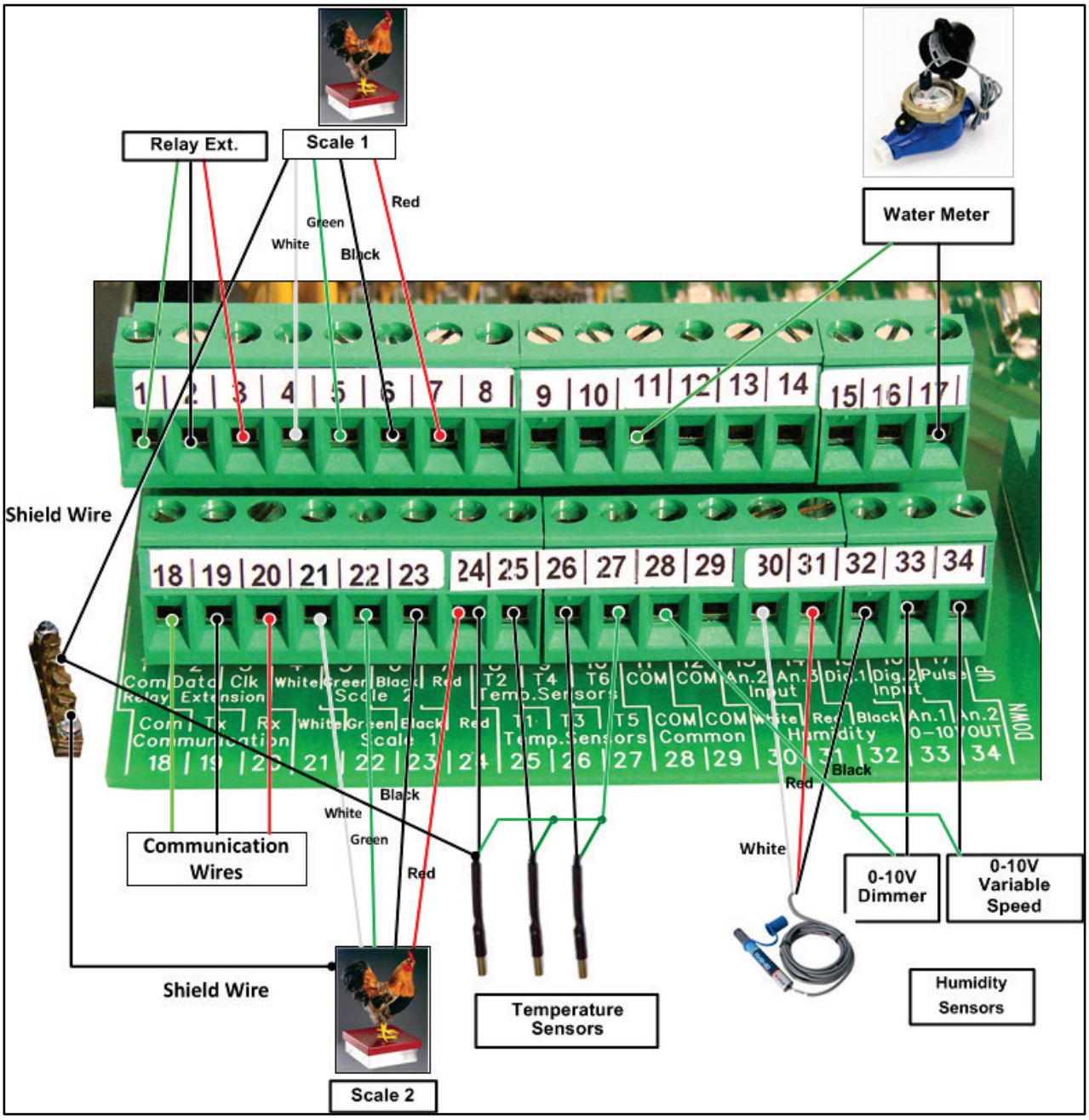
4.2.5 AC-2000 Plus Low Voltage Wiring (Terminals)



NOTE: Connect each cable's shielding wire to the grounding strip. The drawing above is an example only.

NOTE: Users employing a CO2 sensor, refer to Appendix: Installing a CO2 sensor.

4.2.6 AC-2000 Plus Communication Wiring

AC-2000 Plus is wired to a MUX/Communicator via:

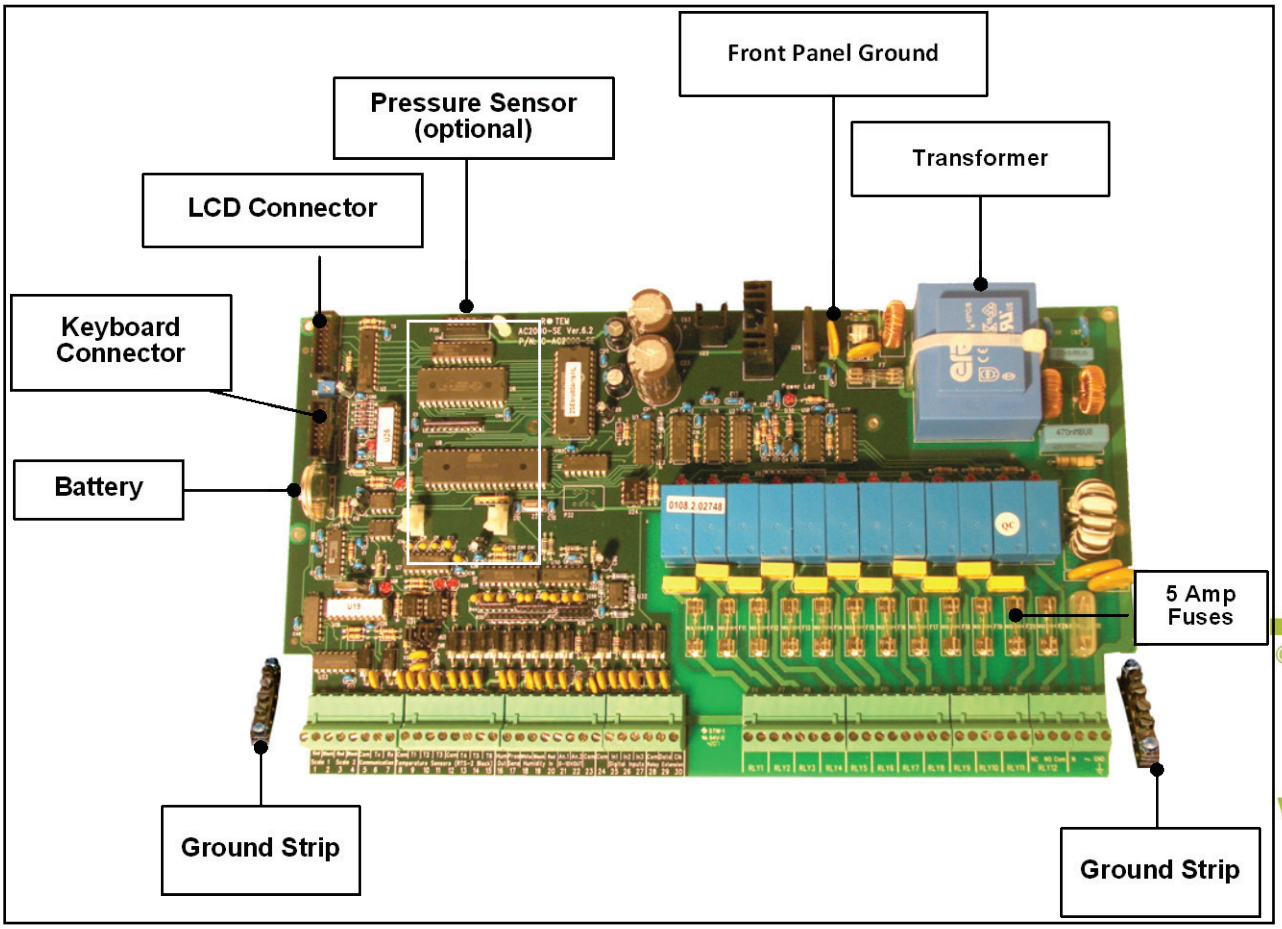
- an internal communication card (P/N C-AC-2000-C232). Connect the communication wires shown in Section 4.2.5 directly to the MUX / Communicator **OR**
- an external RCLP card (see AC-2000 SE MUX / RCLP Wiring, page 17 for wiring instructions)

4.3 AC-2000 SE Wiring

The following sections detail the AC-2000 SE wiring.

- AC-2000 SE Board Layout, page 12
- AC-2000 SE Relays, page 13
- AC-2000 SE High Voltage Wiring (Relays), page 14
- AC-2000 SE Terminals, page 15
- AC-2000 SE Low Voltage Wiring (Terminals), page 16
- AC-2000 SE MUX / RCLP Wiring, page 17

4.3.1 AC-2000 SE Board Layout



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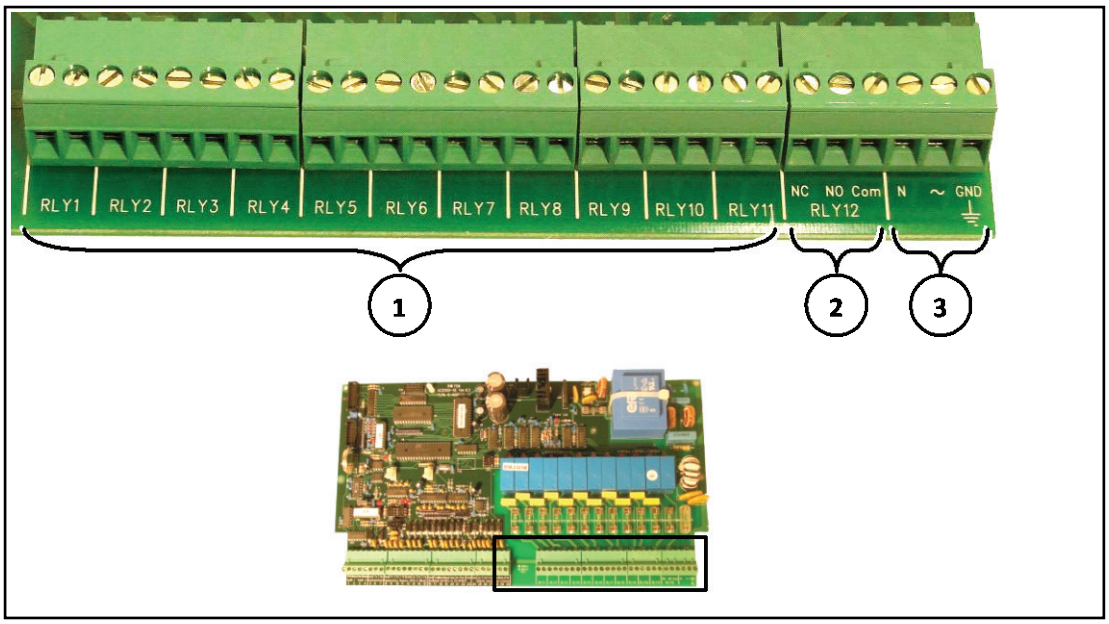
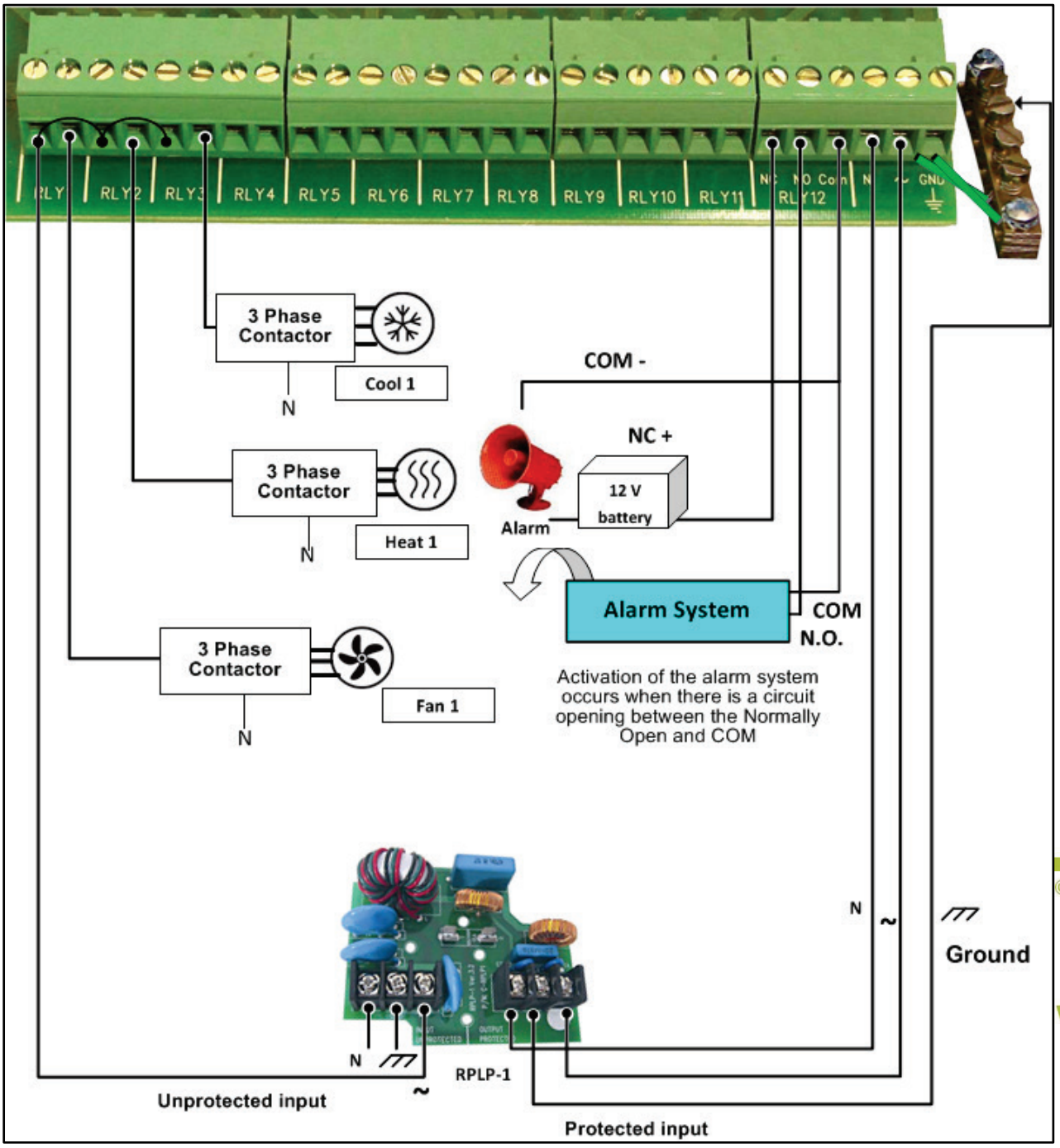
4.3.2 AC-2000 SE Relays



1. **Relays 1 to 11**: Each pair of terminals goes to one relay. These relays are fused with a 5-ampere, 250-volt slow blow fuses. The relays are normally open when not powered.
2. **Relay 12**: Three terminal blocks: This relay normally serves as an alarm relay. It is also fused with a 5 ampere, 250 volt slow blow fuse, and can serve as an ordinary relay:
   - o **NC**: Normally closed contact.
   - o **Com**: Common contact.
   - o **NO**: Normally open contact.
3. **Power**: Three terminal blocks:
   - o **Neutral (N)**: Connect to the Neutral Power line.
   - o **Phase (~)**: Connect to the Phase Power line.
   - o **Ground (GND)**: Connect to a solid earth safety ground, normally with the bare safety ground wire, or a green wire.
4. **Ground**: Connect the ground wire to the electrical system.

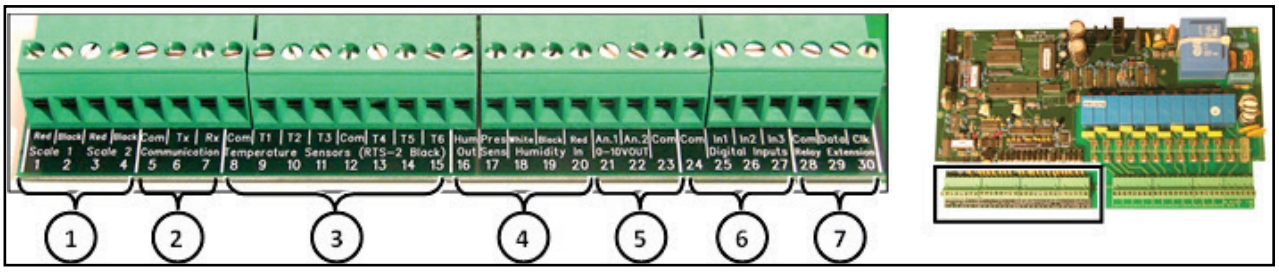
4.3.3 AC-2000 SE High Voltage Wiring (Relays)



NOTE: The device connections (fan, heat, cool, etc.) that are shown in the drawing are examples only!

CAUTION **Connect the AC-2000 SE power input to the protected output only!**

4.3.4 AC-2000 SE Terminals

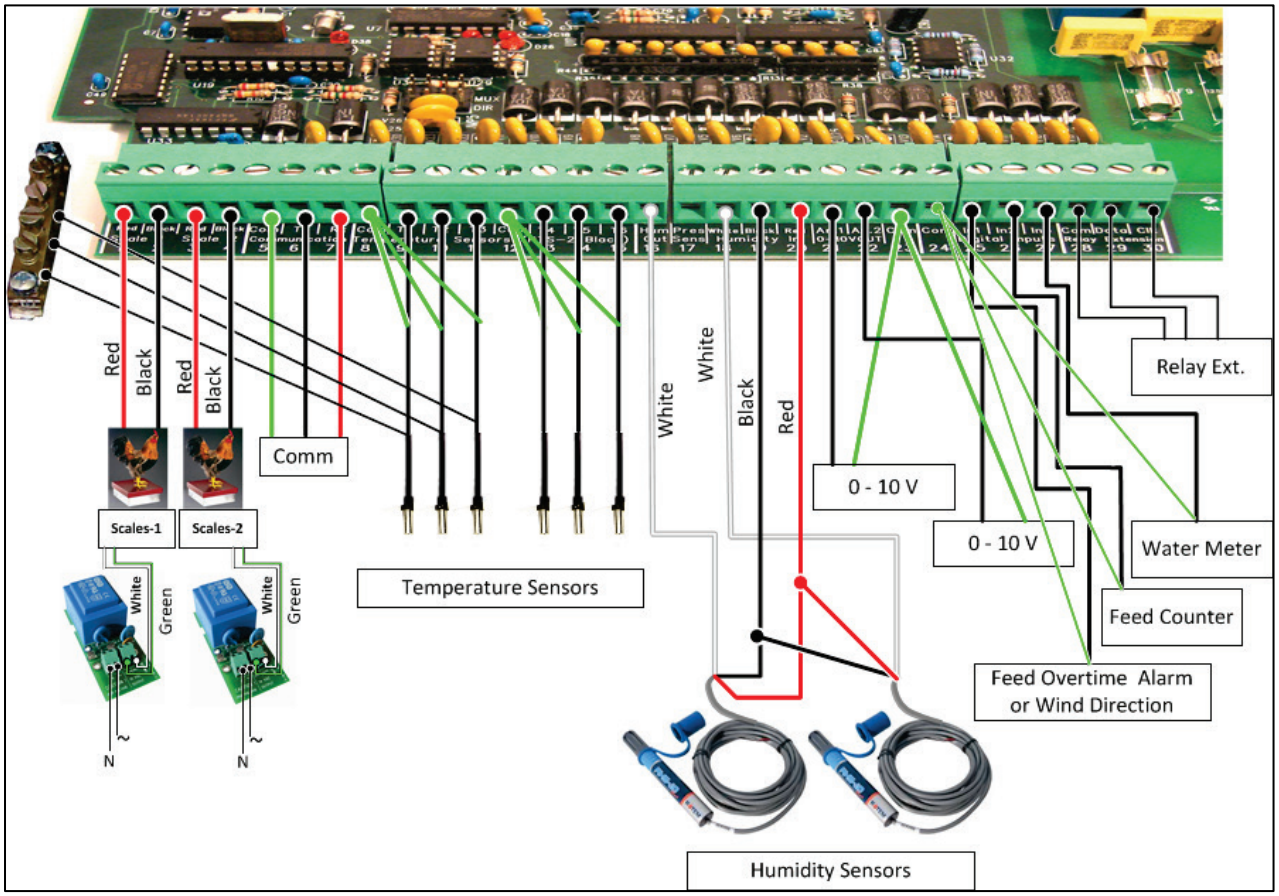

Red Scale 1 1 2
Black Red Scale 2 3 4
Com Tx Rx Communication 5 6 7
Com T1 T2 T3 Temperature Sensors 8 9 10 11
Com T4 T5 T6 (RTS-2 Black) 12 13 14 15
Hum Out 16
Pres Sens 17
White Black Humidity 18 19
Red In 20
An.1 An.2 0-10VOUT 21 22
Com 23
Com 24
In1 In2 In3 Digital Inputs 25 26 27
Com Data Clk Relay Extension 28 29 30
1
2
3
4
5
6
7

1. **Up To Two Optional Bird Scales**: Connect Black and Red of Scale 1 to Scale 1 terminal, and Black and Red of Scale 2 to Scale 2 terminal.
2. **Communications**: Three terminal blocks for PC communication using the optional multiplexor, **MUX-2**.
    - o **RX**: Receive into **AC-2000SE**. With multiple controls, connect all the RX pins together. Connect to TX at Multiplexor only.
    - o **TX**: Transmit from **AC-2000SE** With multiple controls, connect all the TX pins together. Connect to RX only at Multiplexor only.
    - o **COM**: Ground reference for communications. Do not connect shields to this pin. Connect to COM at multiplexor also.

Temperature Sensors: The temperature sensor is a 2 wired black shielded cable thermistor (RTS-2). Connect one wire to the temperature sensor terminal and the other to common (Polarity does not matter).

3. Analog Inputs:
    - o **An.1**: Humidity sensor with wire connections according to wire colors.
    - o **An.2**: Humidity Outside Humidity input. Connect the White wire of the Humidity sensor to An.2 and the Red and Black together with the Humidity input Red and Black.
    - o **An.3**: Pressure sensor (Connect **Red(+)** wire→An.3; **Black(–)** → Common).
4. Analog Outputs:
    - o **An.1**: 0 to 10V- Light Intensity control signal.
    - o **An.2**: 0 to 10V- Variable speed control signal.
5. Digital Inputs:
    - o **Dig 1**: Feed overtime alarm input or wind direction selection.
    - o **Dig 2**: Feed counter.
    - o **Dig 3**: Water meter.
6. **Relay Extension**: **Com** - The relay extension box such as the **REB-8** may be located up to 10 feet from the **AC-2000SE**. Do not connect the shield to this terminal. Connect the shield to earth ground only at one end of the cable to avoid ground loops.
    - o **Data**: This line carries data to the relay extension.
    - o **Clk**: This line carries a clocking signal for use by the relay extension.

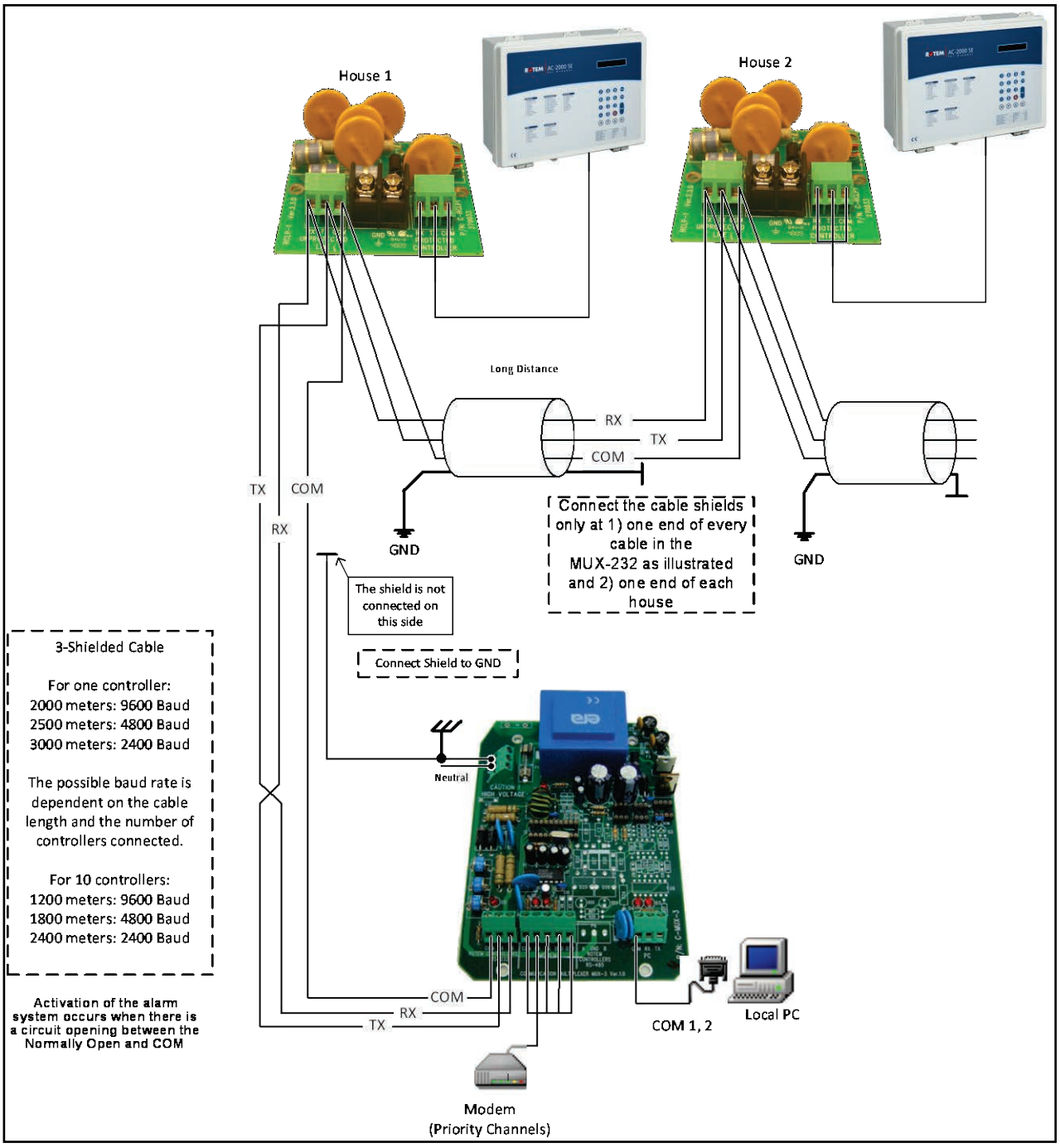
4.3.5 AC-2000 SE Low Voltage Wiring (Terminals)



- Connect the sensor shielding wire to the grounding strip.
    - o **16** – Analog Input 2
    - o **17** – Analog Input 3
    - o **18** – Analog Input 1

4.3.6 AC-2000 SE MUX / RCLP Wiring

AC-2000 SE is wired to a MUX via an external RCLP card.



5 CONFIGURATION

Table 1: Configuration (Version 8.05)

91	Configuration
92	Ventilation Levels
93	Relay Layout
94	Sensor Layout
95	Setup Curtains
96	Male Female Curve
97	System Variables
98	Password

Table 2: Configuration (Version 8.09)

91	Configuration
92	Ventilation Levels
93	Relay Layout
94	Sensor Layout
95	Setup Curtains
96	System Variables
97	Password
98	Wind Chill

The installation menus are not shown on the front panel of the control. They are not used in the day-to-day operation of the control, but only during initial installation.

To get to these menus from the default display:

1. Press **MENU**.
2. Enter the menu number from the Installation Menu.

- Configuration (Menu 91)
- Ventilation Table (Menu 92)
- Relay Layout (Menu 93)
- Sensor Layout (Menu 94)
- Setup Curtains (Menu 95)

5.1 Configuration (Menu 91)

- **Empty House**: This mode prevents new alarms from starting. Alarms that were active before entering empty house continue to be active. While in Empty House mode a blinking indication message constantly appears. Use this mode between flocks when the house is empty and you don't want the alarms to operate. Default: 'off'.

Automatically exiting from an empty house occurs in the following cases:

  - o Changing growth day
  - o New flock
  - o Switching from day '0' to day '1'

- **Celsius** or **Fahrenheit** selection.
- **Communication baud rate** (1200, 2400, 4800 or 9600) for hookup to a personal computer or modem.

- **Maximum number of ventilation levels**: The **AC-2000** supports up to 20 ventilation levels. However, limiting this to a smaller number simplifies the ventilation table.
- **Analog out 1/Analog out 2 (0-3) (0-4 AC-2000 Plus Broilers, Version 8.11):**
    - o '0': None
    - o '1': Variable fan
    - o '2': Light
    - o '3': Variable heater
    - o '4': Variable fan #2 (AC-2000 Plus Broilers, Version 8.11)
- **First tunnel level**: When using tunnel ventilation, enter the ventilation level (in accordance with the ventilation and curtain level tables) at which the system starts tunnel ventilation.
- **Number of heating zones**: The **AC-2000** can control up to six separate heating zones. For one zone only, the average temperature controls the heaters. For two or more zones, the assigned sensors control the heaters in each zone (**Menu 94**).
- **Automatic continuous temperature adjustment**: The **AC-2000** uses precisely the values entered in the temperature tables for each growth period if this is '0'. For automatic interpolation between these entries, enter '1'. The options are as follows:
    - o '0': without
    - o '1': temperature
    - o '2': temperature and Min/Max
- **Barn Number**: This identifies the particular barn for the personal computer at home. Use a unique number for each **AC-2000** to enable the communication program to identify each controller.
- **Curtain opening and closing times**: Enter the number of seconds it takes the curtains to go from fully closed to fully open, and from fully open to fully closed for each curtain. The **AC-2000** uses this value to calculate the run time for each curtain when it moves them.
- **Tunnel curtain opening and closing times**

5.2 Ventilation Table (Menu 92)

Ventilation Level	Ventilation Groups	On Minutes	Off Minutes	Diff	Var	Var #2
1	1 0 0 0 0 0 0 0 0 0 0 0	0.5	9.5	0	0	0
2	1 0 0 0 0 0 0 0 0 0 0 0	1.0	9.0	0	0	0
3	1 0 0 0 0 0 0 0 0 0 0 0	2.0	8.0	0	0	0
4	1 0 0 0 0 0 0 0 0 0 0 0	3.0	7.0	0	0	0
5	1 0 0 0 0 0 0 0 0 0 0 0	5.0	5.0	0	0	0
6	1 0 0 0 0 0 0 0 0 0 0 0	1.0	0.0	0	0	0
7	1 2 0 0 0 0 0 0 0 0 0 0	0.5	1.0	0	0	0
8	1 2 0 0 0 0 0 0 0 0 0 0	1.0	1.0	0	0	0
9	1 2 0 0 0 0 0 0 0 0 0 0	1.0	0.0	0	0	0
10	1 2 3 0 0 0 0 0 0 0 0 0	0.5	1.0	0	0	0
11	1 2 3 0 0 0 0 0 0 0 0 0	1.0	1.0	0	0	0
12	1 2 3 0 0 0 0 0 0 0 0 0	1.0	0.0	0	0	0
13	1 2 3 4 0 0 0 0 0 0 0 0	0.5	1.0	0	0	0
14	1 2 3 4 0 0 0 0 0 0 0 0	1.0	1.0	0	0	0
15 First Tunnel Level	1 2 3 4 0 0 0 0 0 0 0 0	1.0	0.0	0	0	0
16	1 2 3 4 0 0 0 0 0 0 0 0	1.0	0.0	1.0	0	0
17	1 2 3 4 5 0 0 0 0 0 0 0	1.0	0.0	2.0	0	0

Minimum Ventilation

Ventilation Level	Ventilation Groups	On Minutes	Off Minutes	Diff	Var	Var #2
18	1 2 3 4 5 6 0 0 0 0 0 0	1.0	0.0	3.0	0	0
19	1 2 3 4 5 6 7 0 0 0 0 0	1.0	0.0	4.0	0	0
20	1 2 3 4 5 6 7 0 0 0 0 0	1.0	0.0	4.0	0	0

NOTE: The table above shows 12 ventilation groups. AC 2000 Version 8.07 supports 12 groups. Previous versions support eight groups.

The **AC-2000** increases the fan power as ventilation requirements rise. The increments should be proportional from level to level. This means that the ventilation increases about 50% to 100% at each level. For example, at Level One a single fan is set to 0.5 minutes on and 9.5 minutes off. At Level Two, if you set the fan to 1.0 minute on and 9.0 minutes off, there is a 100% increase. At a much higher level, such as ventilation level 15, an increase from 4 fans to 6 fans represents a 50% increase in fan power. Please review the example ventilation tables for this principle.

The ventilation table, **Menu 92**, defines the fan powered ventilation levels for the poultry house. This includes variable speed, timer and on/off fans for up to 20 levels of ventilation. At each ventilation level, a cycle timer can run the highest numbered fan group used at that level. With no values in the timer on and off fields, or only an off time or only an on time, the **AC-2000** defaults to constant on operation.

Due to limited display size, the **AC-2000** shows only the on-off timer or the variable speed setting at each level. Use **Menu 91**, item 4 to select which setting the **AC-2000** shows. However, both settings remain in memory.

Since air movement provides a cooling effect, the **AC-2000** provides a temperature differential at each level. This is particularly important in tunnel ventilation, where the cooling effect can be (–12) °C. The **AC-2000** waits until the target temperature plus the differential before using that ventilation level.

NOTE: The ventilation table coordinates with the curtain table. For natural ventilation, one should regard the curtain table as part of the ventilation table. The two tables together serve as one larger table.

5.3 Relay Layout (Menu 93)

Relay	Code	NO/NC
1	1	0
2	2	0
3	3	0
4	4	0
5	25	0
6	26	0
7…20	0	0

Select **Menu 93** for relay layout. Each relay can work normally or reversed using the NO/NC field. Most relays should be set to normal.

There are twelve/twenty relays inside the **AC-2000 SE / AC-2000 PLUS** respectively, and there may be additional relay extensions. All the relays are numbered sequentially. Assigning the relay code to each relay causes it to assume the particular function. Simply changing the relay code changes the function of the relay.

The alarm output, **code 40**, should be normally closed so that the alarm activates on a power failure. In normally closed mode, the **AC-2000** turns the relay on to turn the function off, and releases the relay to turn the function on. Usually, **Relay 12** is the alarm relay since it provides both normally open and

normally closed contacts. With the extension box, **Relay 20** can serve as an alarm relay instead of Relay 12.

NOTE: After defining the relay, configure System Variables (refer to the User Manual).

Code	Description
1 through 8	Ventilation Group 1 through 8
9, 10	Zone A Heat: Low, High
11, 12	Zone B Heat: Low, High
13, 14	Zone C Heat: Low, High
15, 16, 17	Zone A Radiant Heat: Low, High, Ignition
18, 19, 20	Zone B Radiant Heat: Low, High, Ignition
21, 22, 23	Zone C Radiant Heat: Low, High, Ignition
24	Cooling System
25	Lighting System
26	Feeding System
27, 28	Curtain 1: Open, Close
29, 30	Curtain 2: Open, Close
31, 32, 33	Extra Systems 1 through 3
34	Circulation Fans
35, 36	Positive Pressure Optimizer: Burner, Fan
37, 38	Static Pressure Air Inlet: Open, Close
39	Fogger
40	Alarm
42, 43	Tunnel open/close
45, 46	Curtain 3: Open, Close
47, 48	Curtain 4: Open, Close
49, 50	Zone D Heat: Low, High
51, 52	Zone E Heat: Low, High
53, 54	Zone F Heat: Low, High
55	Fan 9
56	Fan 10
57	Fan 11
58	Fan 12
59	Fogger 2

5.3.1 Manual Relay Operation

Any relay with a code of '0' is not part of the automatic system. However, it follows the NO/NC (Normally Open, Normally Closed) specification. To turn it on manually, (for an extended time, as for installing and for troubleshooting) specify code 0, and set NO/NC to 1. To turn it off manually, set NO/NC to 0.

This method has the advantage that the **AC-2000** will not reset and return it to automatic operation, as it does with test **Menu 33**. It permits the installer as much time as needed to check wiring and electrical connections with the relay in a known position.

NOTE: Return the relay code to the correct function so that AC-2000 can operate it properly.

5.3.2 Relay Record

A permanent record of relay assignments on a small card at the **AC-2000** provides important information for servicing. By referring to the card, the service person can quickly test the correct output and identify problems. Of course, written records of circuit breaker assignments, manual override switches, and other connection information should also be available.

5.4 Sensor Layout (Menu 94)

The **AC-2000** supports up to six heating zones, each with individual heaters. The average of the zones determines the overall house temperature for the ventilation system. **Menu 94** assigns particular sensors to the heating zones for temperature, humidity, and static pressure. It also assigns outside sensors.

Temp Zone A: 1
Temp Zone B: 0
Temp Zone C: 3
Temp Zone D: 0
Temp Zone E: 0
Temp Zone F: 0
Radiation Zone A: 1
Radiation Zone B: 0
Radiation Zone C: 0
Outside Temp: 4
Humidity A: 0
Humidity B: 1
Outside Humidity: 0
Static Pressure: 4 (Internal)
CO2 Analog Input

NOTE: For half or third house brood, set up the zones to prevent averaging in the grow end sensor. If the cold grow end sensor averages with your heated zones, it causes the house temperature to read too cold. This does not affect the heating, since the heaters use the individual zone sensors. However, the ventilation may be incorrect and historical data may show incorrect temperatures since the grow end sensor may have a much different temperature. 'Extra' systems (relay codes 31, 32 and 33), or positive pressure optimizer, if set to average temperature, might work incorrectly.

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Radiant heaters used as brooders can have their own dedicated sensors. These do not affect the average temperature reading. If a static pressure sensor is used, it must be connected to one of the analog inputs in place of a humidity sensor.

1. **Temperature Zone Sensors A, B, C, D, E and F**: Install on any of temperature inputs, 1 through 6. When partial house brooding, reduce the number of zones to exclude sensors not in the brood area. Otherwise, sensors in the grow end will cause erroneous readings.
2. **Outside Temperature Sensor**: Install one of the temperature inputs, 1 through 6. Ensure that the outside sensor has protection from direct sun and hot air currents from the poultry/animal house. Proper placement and shielding is important to successful outside temperature measurement.
3. **Humidity Zone Sensors A, B and C**: Install on any analog inputs, 1 through 3.
4. **Outside Humidity Sensor**: Install on analog input 2 (Out Hum. - 16).
5. **Internal pressure sensor**: Define as analog input 4.

NOTE: If external pressure sensor RPS-1 is used, connect it to terminal 17 (Pres. Sens.) and define as Analog Input 3.

5.5 Setup Curtains (Menu 95)

Minimum Ventilation

First Tunnel Level →

Level	%1	%2	%3	%4	%Tunnel
1…9	0	0	0	0	0
10	15	15	15	15	15
11	25	25	25	25	25
12	40	40	40	40	40
13	60	60	60	60	60
14	80	80	80	80	80
15	100	100	100	100	100
16…20	0	0	0	0	100

- Enter minimum opening percentage for each curtain.
- The curtain table defines curtain levels for up to five curtains (4 natural & 1 tunnel curtains) at natural ventilation levels.
- When in natural mode the tunnel curtain operates as a natural curtain.
- When entering tunnel ventilation mode, the side curtains are closed and the tunnel curtain opens to the minimum % defined in the table. If static pressure increases, the tunnel opens accordingly.
- Exhaust fans may cause curtains to cling to the wiring mesh. For this reason, system variable 23 can allow the **AC-2000** to turn off the fans (all eight groups) if the curtains need to move at small openings. System variable 29 enables a static pressure/curtain movement interlock in case a curtain (relay codes 37 and 38) controls static pressure. The **AC-2000** can then turn off the fans while adjusting the curtain to achieve the desired static pressure.

NOTE: For Menus 96 – 98, refer to the User Manual.

6 TROUBLESHOOTING GUIDE

Problem: **Temperature Sensor does not operate**
Solution:

1. Replace Temperature sensor or connect it to another terminal.
2. Test the Sensor: Disconnect the two wires of the temperature sensor and measure the resistance.
    a) For 25° C the resistance should be 30 Kohm. If the temperature is higher, the resistance should be lower (for example at 42° C the resistance should be 15Kohm). If the temp is less than 25°, the resistance should be higher than 30 Kohm (for example for 15° C the resistance will be 45 Kohm).
    b) If no resistance is measured (∞) it could have been caused by a broken temperature sensor wire.

Problem: **Humidity sensor does not operate**
Solution:

1. Supply Voltage: Check the 12 VDC between the Humidity Red(+) and Black(-) terminal (it should be 7.5 V at least).
2. Check output voltage of the sensor between Humidity White (+) and Black (-). Note that it must be 0.5 ÷ 3.0 VDC (15% to 100% of RH).
    a) If the voltage is 0 or more than 3V the sensor is probably bad.
    b) If the voltage is right (for example 1.5V for 50%) and the **AC-2000** displays the wrong value, it could be that this channel is bad. Move the white wire to a different analog input, define in Menu 94 (sensor layout) and check again.
3. Replace the Humidity Sensor (for **RHS-10PL** replace only the tip).

Problem: **Static pressure sensor does not operate**
Solution:

1. Check that the internal static pressure is defined as 4 in Menu 94 (sensor layout).
2. Shut OFF all fans and close all curtains and inlets so that pressure is at 0. Go to Menu 35 (Analog Input Test) and see that the received value is 65 counts. If it is not at 65 counts, calibrate the pressure sensor by the trimmer to 65.
3. Clean filters, and check that both tubes are not blocked.

Problem: **Digital Input or pulse does not operate**
Solution:

1. Disconnect the wires from the input and check the 5V between the digital input and the common terminal.
    a) If there is no 5 V then probably the input has been damaged (The lightning protection device shorted or the pull-up resistor burned out).
2. Go to Menu 34 and short the digital input of the common. Check if '0' changes to '1'.
3. For the pulse input (water) use Menu 37 and check that the counter increase by one for every short across the pulse terminal.

Problem: **Communication does not operate**
Solution:

1. If Rx and Tx LEDs are permanently ON, switch the wires between the Rx and the Tx.
2. Check that all jumpers are in MUX position.
3. Check all house numbers. There should not be a house number defined as zero, or two houses with same house number.
4. Check that all controllers have the same baud rate, and same as PC.
5. Connect only one controller to the network and check communication. A faulty RCLP can cause the whole network to not communicate.
6. Replace the suspected faulty RCLP.
7. Sometimes the Opto-Coupler isolators in the communication adaptor could be damaged from lightning and needs to be replaced.

Problem: **Relays do not operate**
Solution:

1. If only one relay is not working, check the related fuse.
2. If a group of 4 or 8 relays are not working, it could be that one of the relay coils shorted causing the thermal fuse (automatic fuse) to short.

Problem: **Sporadic resets caused by interference**
Solution:

- It is recommended to install a snubber at the source of interference (for example contactors or motors).

7 ELECTRICAL GROUNDING

CAUTION Always connect temperature and sensor shields to earth ground.
Avoid mixing high voltage wiring with sensor and low voltage wiring.
Keep the controller as far as possible from heavy contactor boxes and other sources of electrical interference.

7.1 Ground Rods

Ground rods are used to efficiently connect the system to earth where current may be dissipated in the soil.

- **Material**: Ground rods should be copper clad or galvanized steel.
- **Diameter**: Minimum 5/8", preferably 3/4". Generally the larger the rod diameter, the lower it's resistance to current flow.
- **Length**: Minimum 2.5 meters (8 feet), preferably 3-meter (10-foot). A longer ground rod will reach a soil with higher moisture content. Moist soil carries current much better than drier soil.
- **Single grounding**: It is important that there is only one grounding location where a rod or series of rods are connected to each other using a ground wire.
- Independent ground rods will increase the risk of current, from a lightning strike for example, being dissipated through one rod and reentering the system through an adjacent rod.
- **Location**: Close to the main circuit breaker panel and in moist soil. For example in an area that is usually wet from a drip or a low spot where water drains. Make sure the area is well protected from damage by lawnmowers, tractors, etc'.
- **Rod installation**: Drive the rod into the earth until about 10 cm (4 inches) is left above grade. If it is impossible to drive the rod to the proper depth, it is acceptable to lay the rod horizontally, 80 cm (2.5 feet) below grade.

In case the rod is exposed to damage, for example by lawnmowers or tractors it can be installed in a hole, about 20 cm (8 inches) deep so that the rod is about 10 cm under grade and 10 cm above hole level.

The National Electric Code (NEC) mandates two ground rods unless you can show less than 10 ohms resistance with one rod.

7.2 Ground Wire

The ground wire is a large copper wire that connects the main circuit breaker panel to the ground rod.

- **Material**: Ground rods should be copper clad or galvanized steel.
- **Diameter**: Typically, 16 mm (6-gauge) copper wire is sufficient. If the wire run is greater than 20 feet, 20 mm (4-gauge) wire should be used.
- **Length**: Minimum 2.5 meters (8 feet), preferably 3-meter (10-foot). A longer ground rod will reach a soil with higher moisture content. Moist soil carries current much better than drier soil.

The ground wire should be protected from damage by lawnmowers, tractors, etc'. It should be buried minimum 15 cm (6 inches) under grade for protection and enter the house as soon as possible. It is important that the wire not be cut; it should remain continuous.

7.3 Ground Clamps

Ground wires should not be merely wrapped around a ground rod. Ground clamps are used to attach a ground wire to a ground rod. The most common clamp is known as an acorn clamp. Make sure the ground clamps you select are rated for outdoor use. Do not use pipe clamps rated for inside water lines or hose clamps to attach the ground wire.

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7.4 What Should Be Grounded?

Any equipment that is or could become energized, even accidentally, should be grounded. Current from lightning, strikes objects in a random fashion. Accounts of lightning strikes reveal scenarios most of us could not predict.

Electric circuits should be wired with a 3-wire conductor consisting of hot, neutral and grounding wires. The grounding wire should be attached cleanly and securely to devices or systems to be grounded. The other end of the grounding wire should be attached to the ground bus on the main panel.

7.5 Lightening Protection

Because of the potential for lightning damage to electronic devices, Rotem recommends supplying lightning protection on both the power supply and the communication terminals (if used).

7.5.1 Power Line Protection

The Rotem **RPLP-1** provides lightning protection to the **AC-2000 Controllers**. Refer to the **RPLP-1** documentation for detailed wiring instructions. While no lightning protection is perfect, the **RPLP-1** significantly enhances the reliability of built-in lightning protection. In addition, Rotem recommends using an isolation transformer in front of the **RPLP-1** to help block lightning and other transients.

NOTE: Common surge protectors provide little additional protection, and may trip unnecessarily.

An isolation transformer preceding the **RPLP-1** provides significant additional protection against lightning.

7.5.2 Communication Line Protection

The Rotem **RCLP-1** provides communication protection for the **AC-2000**. Refer to the **RCLP-1** documentation for detailed wiring instructions. Since outdoor communication lines can receive and conduct powerful electromagnetic pulses into the controllers and cause significant damage, Rotem advises using a **RCLP-1** prevent damage to the units.

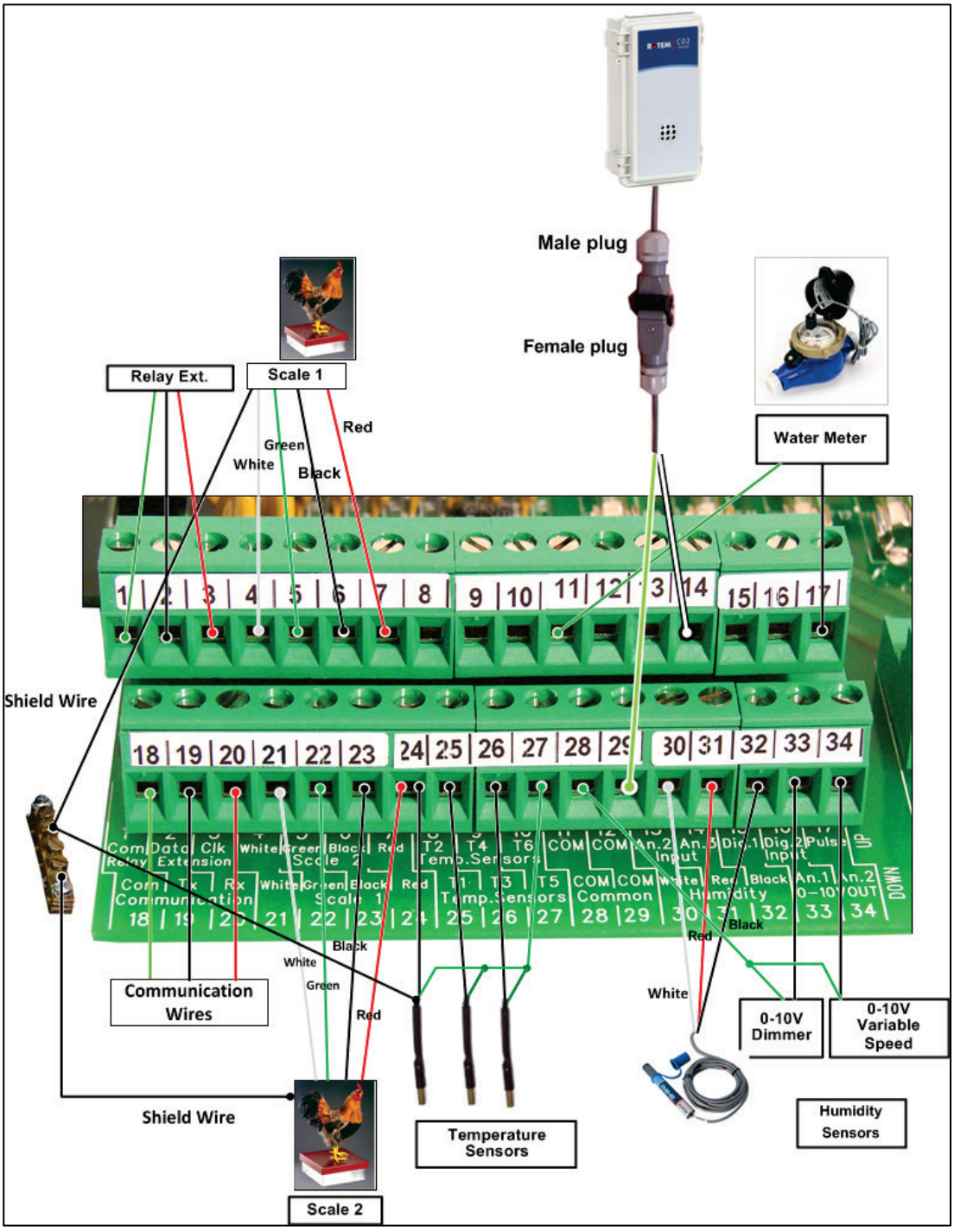
NOTE: Common surge protectors provide little additional protection and may trip unnecessarily.

8 APPENDIX: INSTALLING A CO2 SENSOR

The following section details the steps involved in installing a CO2 sensor.

8.1 Low Voltage Wiring

AC-2000 Plus Broiler, Version 8.11 support a CO2 sensor. Wire the unit as shown below.



- Co2

8.2 Configuring the CO2 Sensor

- In the CO2 sensor, verify that the J2 jumper is shorted. Refer to Figure 2.

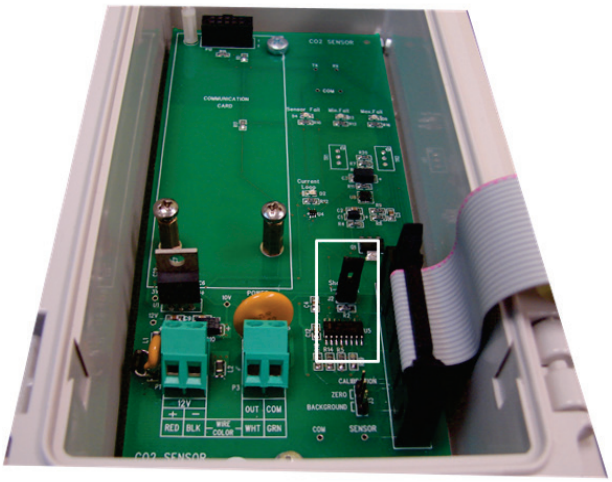


Figure 1: J2 Jumper Shorted

- All other installation instructions are the same. Refer to the CO2 Manual (P/N: 110227) for details.